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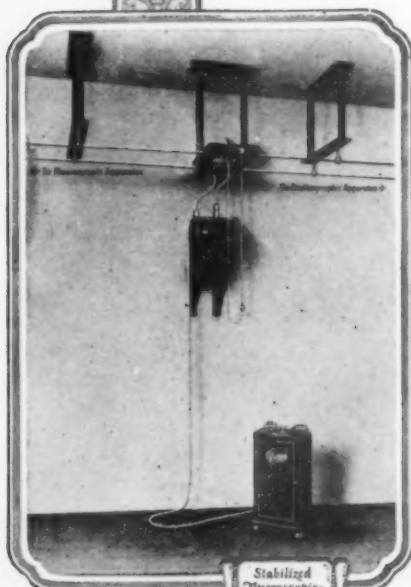
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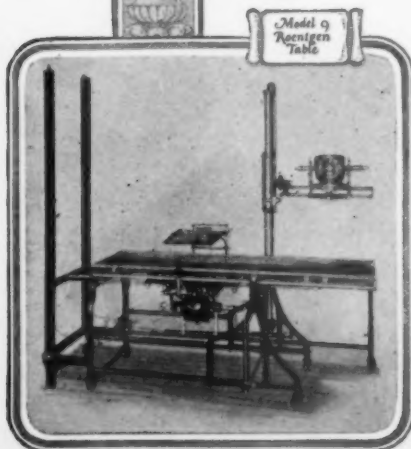
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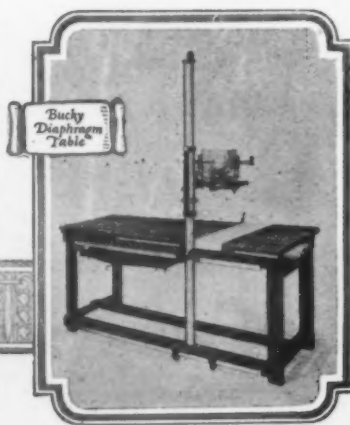
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**VICTOR**

# The JOURNAL OF RADIOLOGY

## Omaha, Nebraska

VOL. IV

JUNE, 1923

No. 6

### A Study of Lung Abscess by Serial Radiographic Examination\*

(From the X-Ray Department of City Hospitals Nos. 1 and 2)

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St. Louis

SERIAL radiographic examinations have proved to be of great value in studying the progress of all pathological lesions, but in no condition have they proved of greater advantage than in acute inflammatory conditions of the lungs. Because serial studies have been so helpful to the better understanding of the cause and progress of the various pneumonias<sup>1,2</sup> it was thought that a similar method might be of advantage in the study of lung abscesses, hence this study, which is based on the radiographic examination of 45 cases of lung abscess occurring at City Hospitals No. 1 and No. 2, and their allied dispensaries during the past three and one-half years.

Before passing to the description of the various radiographic types of abscess encountered in this group, let us define just what is meant by "lung abscess" and just what type of cases should come under consideration in this discussion. By "lung abscess" we mean an acute inflammatory disintegration of lung tissue occurring within the lung, involving the lung substance itself, as a result of the invasion of pyogenic microorganisms. This excludes abscesses due to the tubercle bacillus and all suppurative processes of the pleural cavity, such as empyema, general or localized, or small pus collections occurring in association with serofibrinous plastic pleurisy. Such a condition presupposes an area of pneumonic consolidation in the lung as nature's effort to erect a barrier to the invading organism, and in this respect all abscesses may be considered to be postpneumonic consolidations thrown out as nature's effort to limit a pyogenic infection, similar to a like process occurring elsewhere in the body. Let us confine the use of the word "pneumonia" to the acute consolidations of the lung commonly understood by this term—namely, bronchopneumonia and lobar pneumonia.

With this conception of the words, "lung abscess" and "pneumonia," let us endeavor by the aid of serial roentgenographic examinations to investigate the characteristics and the progress of the disease as it appears in its different clinical forms. To be of the greatest value for such a study, the pathological lesion must be observed from its inception and its progress noted. Many of our cases came under observation when the condition was well established and the lesion far advanced. A considerable number, however, have come under observation at the very beginning of the disease, so that a complete record of the condition is available.

Clinically, lung abscesses are known to occur:

(1) Postoperatively, especially following operations on the upper respiratory tract.

(2) After the aspiration of infected material.

(3) After exposure to cold.

(4) Following influenza (not the epidemic type).

(5) Idiopathic, without apparent cause.

(6) As a sequel in lobar pneumonia.

(7) As a result of bronchopneumonia.

(8) In septicemia from septic thrombi or following septic pneumonia.

(9) From lymphatic extension or regional drainage.

(10) From direct introduction of infected material into the interstitial tissue of the lung as a result of destruction of the esophageal wall by carcinoma.

Six of the cases of this series occurred postoperatively, two followed

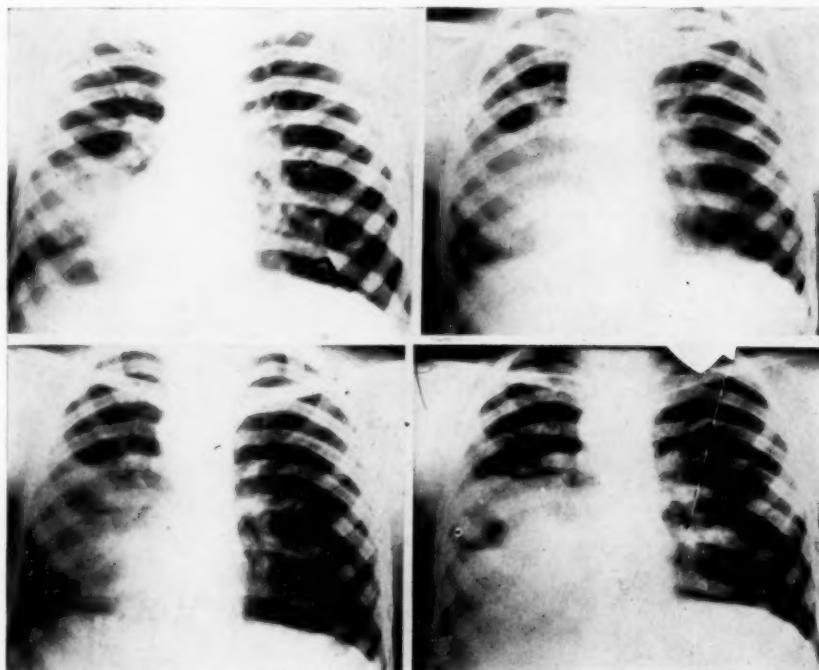


Fig. 1.—Abscess of the lung following six days after tonsillectomy under ether anesthesia. (a) The process began as a consolidation in the hilus region. (b) The consolidation increased rapidly in size and progressed toward the periphery. (c) Early in the course of the disease a rarefied area appeared in the midst of the consolidation. (d) The process did not go on to spontaneous healing, but resulted ultimately in a chronic interstitial pneumonia and multiple abscess formation.

\*—Read at the Annual Meeting of the Radiological Society of North America, Detroit, Dec. 4, 1922.



tonsillectomy, one heriotomy, one appendectomy, one cholecystectomy, and one an operation for ruptured duodenal ulcer. The first case (Fig. 1), which we shall study as representative of this group, followed tonsillectomy. Six days after the tonsil operation, under ether anesthesia, attention was directed to the chest, and radiographic examination made at that time disclosed a consolidation confined to the hilus region. Subsequent radiograms taken at daily

intervals revealed the rapid increase in the size of the consolidated area and indicated its progression toward the periphery. Shortly after the onset a rarefied area was seen in the midst of the consolidation, establishing the diagnosis of abscess formation. Such a rarefied area may be seen at a single examination and not be detected on subsequent plates. It may be seen regardless of whether the abscess cavity has ruptured into a bronchus or not. In

this instance it could be detected before rupture had occurred. When about one week later rupture of the abscess and evacuation of the pus through a bronchus did occur, the inflammatory consolidation subsided rapidly. The process did not go on to spontaneous healing, however, and considerable evidence of a persistence of the lesion was left on the radiogram. Subsequent exacerbations left the entire lower portion of the lung filled with multiple abscess cavities.

One other case of lung abscess following tonsillectomy began in precisely the same manner and ran the same radiological course. Rupture of the abscess and evacuation of the pus occurred early in the course of the disease and the condition resulted in a complete spontaneous recovery.

The four other cases included in this group followed abdominal operations, done under ether anesthesia; one for appendectomy, one for heriotomy, one for cholecystectomy, and one for a perforating duodenal ulcer.

The following case is representative of this group of postoperative abscesses (Fig. 2). The patient was admitted to the hospital with acute appendicitis and an appendectomy was performed under ether anesthesia. Postoperative convalescence was uneventful for six weeks, when a high temperature, together with pain in the chest, prompted examination of the lungs. A consolidation limited to the hilus region was encountered, which on early examination showed extension of the consolidation to the periphery. Early in the course of the disease a rarefied area was noted within the consolidated area. Spontaneous evacuation of the pus was followed by complete rapid recovery, the entire process requiring only about five weeks. In neither of the other two cases of this group was there spontaneous cure. One came on a few days after operation, one other was discovered ten months after operation for hernia.

From the similarity of the radiographic findings in these cases and the widely varying character of the operative procedure, it seems most probable that the only common factor involved in all of the cases (namely ether anesthesia) must be in some way responsible for, or concerned in the production of the condition. It is possible that the condition might be due to aspiration of foreign material while under anesthesia and the radiographic findings would seem to point to an invasion of the lung by way of the air passages. That some other factor is also concerned in the production of the condition there seems little doubt, in so far as many patients who aspirate large quantities of infected material never develop lung abscess, whereas some in whom no such history

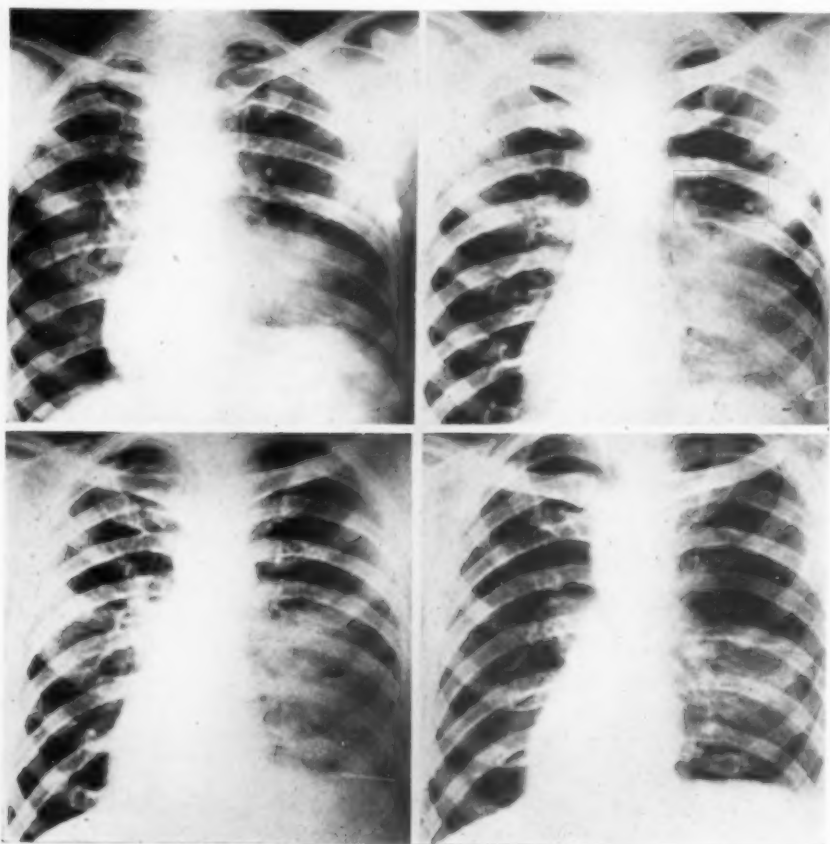


Fig. 2—Abscess of the lung following six weeks after appendectomy under ether anesthesia. (a) In this case, likewise, the original consolidation was in the hilus region. (b) Increase in size of the consolidated area followed. (c) A rarefied area (abscess cavity) soon appeared within the consolidation. (d) Rupture and evacuation of the pus through a bronchus resulted in prompt and complete recovery.



Fig. 3—Acute lung abscess probably resulting from aspiration of infectious material from a co-existing tuberculous lesion. (a) As in the previous cases, the original consolidation was seen in the hilus region. (b) This rapidly increased in size and soon a definite abscess cavity was seen in its midst.



is obtainable develop the condition without apparent cause. Lowering the resistance of the bronchial mucous membrane, either locally by anesthesia, by repeated aspiration of infectious material, etc., or generally by the intercurrent of some general disease such as diabetes, carcinoma, etc., may be the factor which provides a fertile field for the bacterial invasion.

On close observation of the history of our cases, not a single one was encountered in which a definite history of aspiration of foreign material was followed immediately by abscess formation. One case was encountered in a patient suffering from tuberculosis of the opposite lung, in which acute lung abscess occurred probably from the aspiration of infectious material into the normal lung. (Fig. 3). The onset of the disease, with a definite hilus consolidation, and its course are very similar to those described under postoperative abscesses, and it is probable that they both represent the invasion of the lung by the air passages. The matter of dosage may be considered as a contributing factor—a single inoculation of infectious material being thrown off, but, as was evidently the case in this instance, the repeated aspiration of infectious material from the co-existing pathological condition in the opposite lung resulted ultimately in the patient succumbing to the infection. It is not, however, exactly clear why lung abscess should follow six weeks after operation in one case and ten months after operation in another if aspiration of infectious material while under ether were the sole cause.

That exposure to cold may be the only demonstrable factor in the production of lung abscess is evidenced by the following case. This patient, in apparently good health, boarded a freight train a hundred miles or so away from St. Louis, with the intention of stealing a ride to his destination. While on the train he was exposed for several hours to a piercing cold rain, which drenched him to the skin. On his arrival in St. Louis he had to be removed at once to the hospital and an x-ray examination (Fig. 4) made the next morning disclosed a consolidated area in the hilus region, which, on subsequent examination, rapidly extended to the periphery. That the process was primarily a lung abscess is evidenced by the fact that on the sixth day after the onset a definite rupture occurred and pus was evacuated in large quantities. The very foul odor of his breath suggested a gangrenous process and a rather refractory hiccup lead to the suspicion of subphrenic involvement. Pneumoperitoneum examination, however, disclosed the subphrenic space free from involvement. The condition ended

in spontaneous recovery. The rapid onset of consolidation after exposure to cold would render the possibility of an intercurrent influenza infection unlikely, and it is quite probable that in this instance the exposure to cold was all that was necessary to bring about the condition favorable for abscess formation. That this is a possibility, however, must not be overlooked.

Two cases included in this series followed clinically typical cases of influenza (not the epidemic type) (Fig. 5). Plates taken during the influenza stage showed nothing other than the increase in peribronchial markings and the increase in hilus shadows ordinarily found in this condition<sup>3</sup>. Apparently without intercurrent pneumonia, or, at least, very soon after the onset

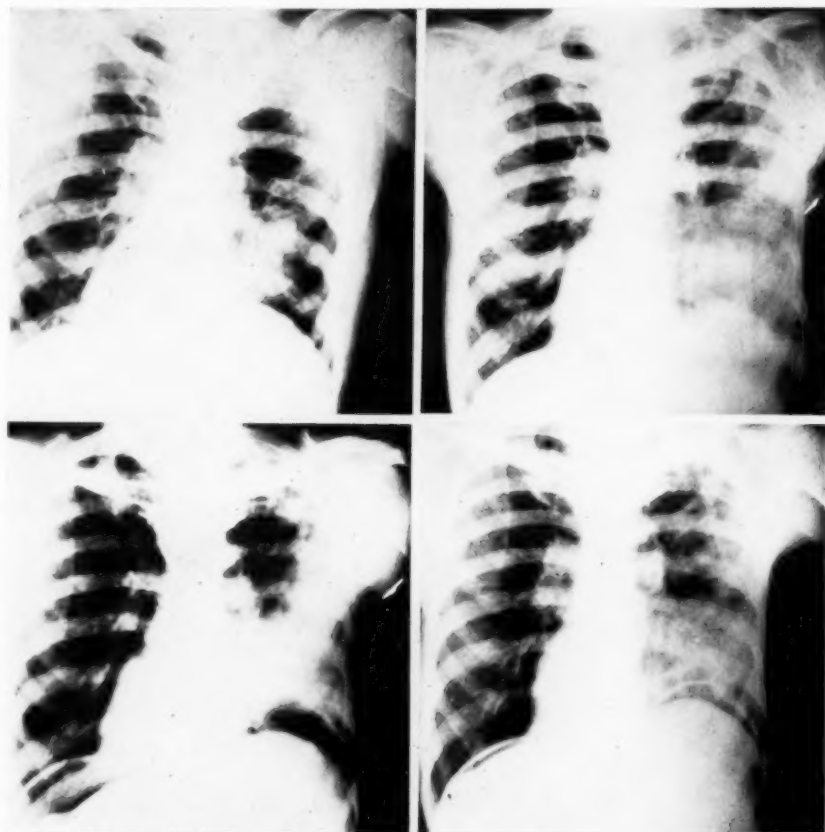


Fig. 4—Lung abscess following exposure to cold. Patient was exposed to cold and wet weather for several hours previous to his illness. (a) Radiographic examination made within twenty-four hours revealed a consolidation confined to the hilus region. (b) This rapidly spread towards the periphery until it involved the entire lower portion of the lung. (c) A persistent hiccup and a foul odor to the breath suggested gangrene and subphrenic involvement. Pneumoperitoneum examination revealed the subphrenic space clear. (d) Evacuation of pus through a bronchus was followed by prompt spontaneous cure.

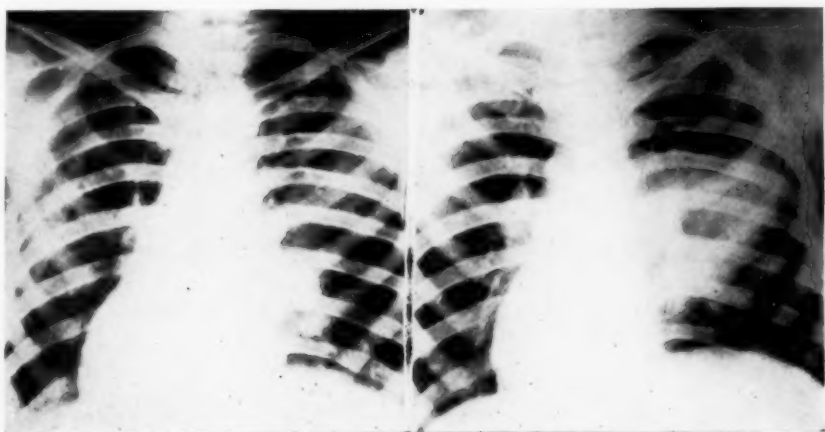


Fig. 5—Abscess of the lung following three weeks after an attack of influenza (not epidemic type). (a) During the influenza stage nothing beyond the increase in peribronchial markings and hilus shadows customary with influenza was noted. (b) After a latent period of several weeks abscess formation began and in a very short time a definite abscess was established.

of the pneumonic consolidation indications of abscess formation were present.

In the beginning a leukopenia was present, but upon the formation of an abscess this gave place to a marked leukocytosis. The onset and course, as will be observed, is very similar to that described in the previous types; it started as a hilus consolidation and rapidly progressed to the periphery with subsequent abscess formation.

That some of the cases of so-called insidious or idiopathic origin may be sequelae of an influenza infection is also quite possible. Eight cases in our series were of this idiopathic type and are well represented by the following case (Fig. 6). Without apparent cause the patient was taken sick with pain in the chest, dyspnea and fever, chilly sensations and chills, followed by profuse sweating. Radiographic examination made at this time revealed a distinct hilus consolidation.

Similar to the preceding cases which followed influenza infection, the acute consolidation was seen in this instance to appear first in the hilus region. There

was this difference, however, that in the cases following influenza infection a period of time elapsed during which no consolidated area was demonstrable in the chest, while in this case of insidious origin no such interval was noted, the hilus consolidation appearing simultaneously with the onset of the illness. Radiographic examinations made at daily intervals revealed the enlargement of the hilus shadow and its progression outwards, and on the third day disclosed an area of rarefaction within the consolidation which established at once the character of the lesion. Subsequent radiographs revealed the extension of the consolidation until it occupied the entire lower portion of the chest simulating at one examination a lobar pneumonia and at the next a large pleural effusion, although the subsequent cause of the disease disclosed that no fluid was ever present in the free pleural cavity. At this stage rupture of the abscess occurred and the pus was evacuated through a bronchus. Rapid resolution of the process resulted and within two weeks the consolidated

area had again receded to the size encountered at first examination. While such a rapid recession is a very favorable sign for an ultimate spontaneous recovery, yet the subsequent history of this patient should be a warning that apparent clinical cure is not always absolute cure. This patient, at this stage of the disease, felt so well and was so much relieved that he demanded his discharge and was dismissed. In about one month the patient "suffered a relapse" and was again admitted to the hospital. Roentgenographic examination at that time revealed multiple abscesses in the lower lobe with interstitial pneumonia, a condition far worse than at any other time of the disease.

A brief review of all of the groups here represented will disclose a striking similarity. That they all represent invasion of the lung by way of the bronchi seems quite evident from the radiological evidence. All start as a hilus consolidation, and progress peripherally and without distinction to lobar involvement, often showing a rarefied area of tissue destruction early in the

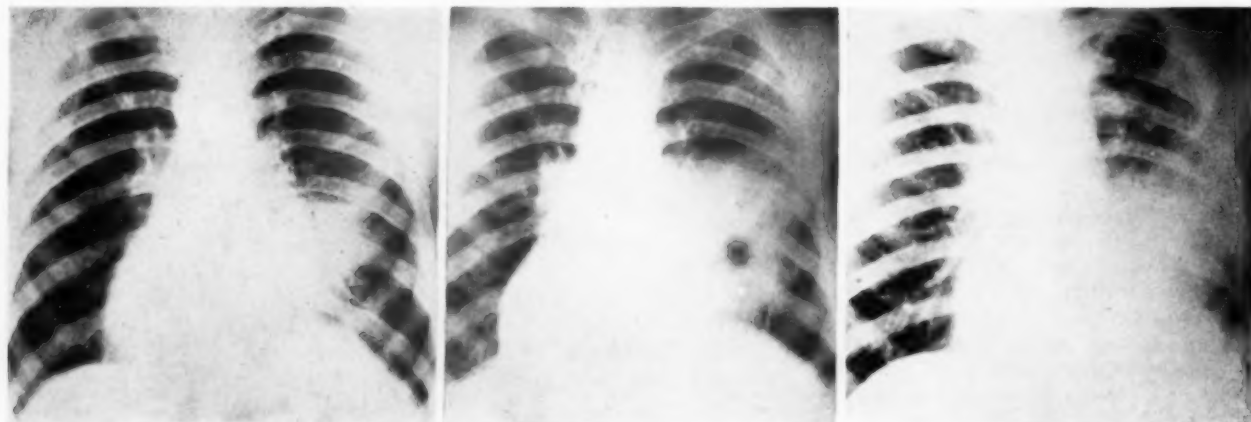
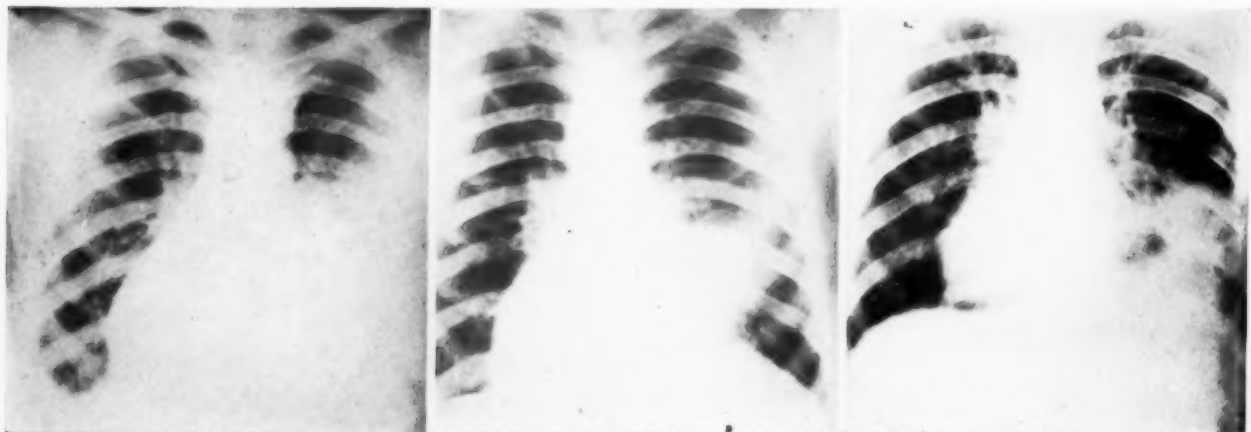


Fig. 6—Idiopathic type of lung abscess. (a) Without apparent cause or reason the patient was seized with a chill, high temperature and pain in the chest. Radiographic examination at this time revealed a consolidation in the hilus region. (b) Within three days a definite abscess cavity was seen in the midst of the consolidation. (c) The consolidation increased rapidly in size. It is noteworthy that the abscess cavity previously seen was no longer discernible.



(d) Within less than one week the consolidation had involved the entire lower lobe, giving in the radiograph the appearance of free fluid in the pleural cavity. (e) That no fluid was present in the pleural cavity, however, is evidenced by the rapid recession of the inflammatory consolidation following evacuation through a bronchus. This radiograph representing

a size scarcely larger than the original consolidation was again attained after less than two weeks. (f) The patient was readmitted to the hospital one month later with an acute exacerbation which resulted in interstitial fibrosis and multiple cavity formation.



Fig. 7—Lung abscess following lobar pneumonia. (a) Right upper lobar pneumonia showing consolidation confined to this lobe. (b) A partial resolution of the pneumonic consolidation has taken place, but a large abscess cavity is seen in the remaining consolidation. (c) Rupture of the abscess into the

pleural cavity occurred, causing a general empyema. A small amount of fluid can be seen in the lower chest. The cavity previously present in the upper lobe disappeared completely within a few days with the resolution of the remaining pneumonic consolidation.

disease. At this stage rupture of the abscess and evacuation of the pus into the bronchus may occur or rupture may occur into the pleural cavity and empyema result. They may result in spontaneous cure or may require surgical intervention.

The next class of cases to come under consideration may properly be considered as being respiratory in origin also; namely, those occurring after lobar and bronchopneumonia. They vary in this respect, however, that they are secondary to a previous consolidation within the lung. The manner of onset of abscess formation varies somewhat in lobar and bronchopneumonia. In lobar pneumonia the consolidation characteristic of the disease when first encountered is limited to one or more lobes. The disease progresses and either the temperature falls with crisis, only to be followed shortly after by another rise, or, the temperature may never fall by crisis, but may gradually assume a septic form. In either event the consolidated area persists at least in its central portion and later an abscess cavity appears in its midst. When once established such an abscess cavity progresses much the same as the other forms previously described. There may be rupture into a bronchus with discharge of the pus, or rupture into the pleural cavity with empyema formation may occur; spontaneous recovery may result or the process may pass into a chronic state with formation of numerous abscesses and an interstitial pneumonia which can only be cured by surgical intervention (Fig. 7). In the case illustrative of this group a right upper lobar pneumonia was followed by an abscess. The definite outline of the abscess cavity can be seen. Rupture of the abscess occurred into the general pleural cavity causing an empyema. It

is noteworthy that rupture of the abscess in this instance was followed by complete resolution of the remaining inflammatory process.

Seven cases following lobar pneumonia occurred in this series.

In bronchopneumonia the small peribronchial infiltrations become necrotic and form small abscesses. These coalesce and form larger abscesses in the mid-portion of the lung. Their appearance is quite characteristic. Six cases following bronchopneumonia were encountered in this series (Fig. 8).

The next class of cases which present themselves for our consideration are those of hematogenous origin. Two of our cases were of this type and both occurred during septicemia, which followed incomplete abortion. Curettage was performed in one case, but in neither was a general anesthetic administered. While neither of these cases came under observation at an early enough date to permit an accurate statement as to the definite course of the disease, it can be said that in a general

way these abscesses start as a haze overlying the entire lower portion of the lung, much the same as septic pneumonia (Fig. 9).

Lung abscess in the regional lymphatics may result from the drainage of a septic process, even though the original process itself may not result in suppuration. Such a condition is seen where abscesses of the lung follow infected conditions in the esophagus—infected carcinomatous ulcer (Fig. 10). In the case which I have chosen to illustrate this group there was a suppuration of a hilus lymph node following a pneumonic process in the lung. The hilus abscess remained long after the primary pneumonic consolidation which caused it had resolved. Where abscess formation is suspected in the hilus region the lateral view is of greatest aid in detecting its presence. Note the thickening of the inter-lobar pleura incident to the infectious process. Three cases were of this type.

The last type of lung abscess which will be discussed is that caused by a

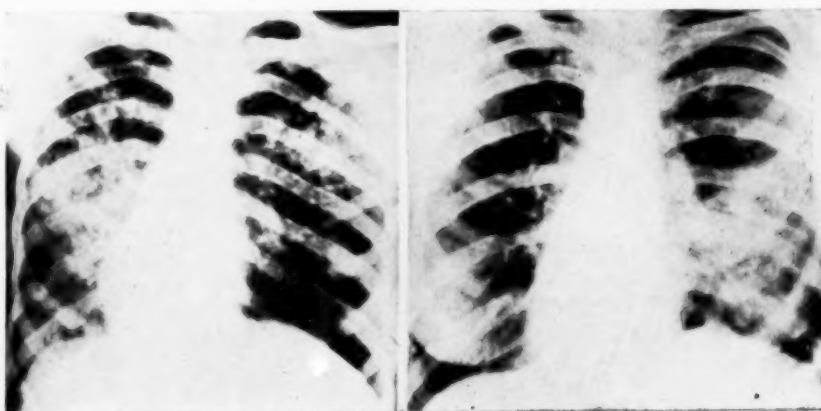


Fig. 8—Abscess of the lung following bronchopneumonia usually represents the coalescence of small abscesses formed from small necrotic areas in the lung.

Fig. 9—Lung abscess following septic abortion. No anesthetic was given and the process was probably hematogenous in origin.



direct extension of infectious material into the interstitial tissues of the lung, due to rupture of the esophagus by malignancy, foreign body or other cause (Fig. 11). In the case illustrative of this group there was complete destruction of the esophagus by carcinoma, and a discharge of infected food material occurred directly into the interstitial tissue of the lung and formed a large abscess. It is noteworthy that a barium meal filling the cavity in this way was never coughed up through the bronchi, but was expelled by vomiting and regurgitation. The patient lived for three months in this condition with com-

paratively little discomfort. This is the only case of this type which occurred in our experience. The barium filled cavity was of great importance in the localization of the cavity and illustrates the practical value of this method recommended by Stewart and Lynah<sup>4</sup> after bronchoscopic injection. In eight of our cases the history was so indecisive that classification was impossible.

A brief analysis of the 45 cases here outlined might be of interest. With the exception of the three upper lobe cases, two bronchopneumonia cases, one post-operative case and one aspirative case, all of our patients had involvement of

the lower right lung. No particular type of involvement showed any special predisposition to spontaneous cure. Clinically, a patient may appear completely cured, while radiographic examination may reveal a remaining pathology which as long as it is present represents potentially a grave condition. This has been well shown by Wessler<sup>5</sup> who illustrates an instance in which an almost insignificant appearing remnant of pathology in the chest resulted in a short time in an extension of the process which involved the entire lower lung with multiple abscesses. Our experience in a number of cases has been in accord with this examination. Any remaining pathological process is a potential factor for the rapid reinfection of the remaining lung.

#### SUMMARY

In general, lung abscesses may be said to invade the lung first by the respiratory system, either as a primary process following some condition in which the local or general resistance is lowered, or following a lobar or bronchopneumonia; second, by the blood stream in association with a septic process elsewhere in the body; third, by invasion through the lymphatics and suppuration of the regional lymph nodes due to drainage of some septic process; fourth, by direct extension from the interjection of infected material into the interstitial tissues of the lung as a result of destruction of the esophageal wall.

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Fig. 10—Lung abscess due to suppuration of a hilus lymph node following drainage of a pneumonic process in the lung. (a) In the anterior view nothing suspicious of abscess can be seen. (b) But in the lateral view the definite abscess can be made out. Note the thickening of the interlobar pleura mapping out the confines of the lobes.



Fig. 11—Lung abscess due to the direct projection of infected food material into the interstitial tissues of the lung, as a result of the destruction of the esophageal wall from carcinoma. (a) Showing the destruction of the esophageal wall from carcinoma. (b) Showing the large area of consolidation in the lung with the large barium filled cavity in its midst.

# Studies of the Effect of X-Rays on Glandular Activity\*

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Chicago

## PART I.

### GENERAL CONSIDERATION OF BIOLOGICAL PRINCIPLES

WHEN a cell is acted upon by some outside influence it may be affected in one of four ways: It may be stimulated, depressed, irritated or destroyed. Factors which enhance the activity of an organ stimulate it, and those which decrease the activity of an organ depress it. Factors which cause a change in the nutrition and growth of a cell are said to irritate it. (1, 2)

Stimulation results in a quantitative increment in the specialized function of an organ, for example, in the gastric glands an increase in the formation of gastric juice, or in the spinal cord an increase in the reflex excitability. Following excessive or prolonged stimulation, the activity of an organ in many cases becomes depressed and may lose all of its functional activity (paralysis), which is more true for muscular and nervous activity than for glandular activity. (3) Fatigue and depression are then physiologically analogous so far as the end result is concerned, although they may be of a different cause. However, a fatigued organ as a rule recovers rapidly, while a depressed organ does not recover until the depressant or toxic substance is neutralized or eliminated. A fatigued or depressed organ may be functionally dead from excessive stimulation and then recover completely its normal functional activity, if death of the organism itself does not occur.

It is claimed by some authorities (Arndt-Schulz Law) "that depression is invariably preceded by stimulation, and that stimulation sufficiently prolonged invariably leads to depression and paralysis." Such a statement Cushney<sup>(1)</sup> claims is too absolute and he cites the well known example of the action of atropin on the cardiac vagus nerve endings, which is always depressant. The action of curare and of morphine on the cord are also good examples. So we cannot always say that a factor which in large doses depresses will in small doses stimulate. (4, 5, 6, 7)

While a stimulant causes a quantitative increase in specialized function, an irritant leads to a change in nutrition and growth. Stimulation is observed and studied in highly specialized cells, such as are found in the heart, nervous system and secretory glands, while irritation may be observed in all tissues and "is the commonest change caused by drugs" and other factors in the less specialized forms of tissue, such as connective tissues and ordinary epithelia. (1)

Recovery can occur following excessive stimulation, but excessive irritation results in necrobiosis and cytolysis. For example, a muscle can be stimulated with an electrical current until it is paralyzed and it will soon recover, but let it be irritated with some chemical irritant such as ammonia vapor or a strong sodium chloride solution until it no longer responds and it will not recover. In the frog strychnin will first stimulate the cells of the spinal cord and then completely paralyze them and recovery will occur in a few days when the strychnin is eliminated. In contrast a small amount of an irritating substance injected subcutaneously causes a vasodilation, transudation, proliferation and fibrosis, a large amount injected to make the irritation intense causes necrobiosis, and an abscess results. The cells that were killed cannot recover, but their places are taken by cells produced as a result of the irritant where it was less concentrated and the less intense irritation caused proliferation of cells. We are aware that cantharides, which is an irritant, when administered internally, causes a diuresis, but as to whether this action is to be interpreted as meaning a stimulation of the secretory activity of the kidney is a highly debatable question.

So we are of the opinion that stimulation and irritation should not be considered as identical terms and applied synonymously when speaking of physiological reactions to external factors.

If the x-ray has an irritant action it will cause a change in the nutrition and growth of cells rather than affect directly specialized functions. It will affect more readily connective tissues, ordinary epithelial and embryonic cells. In small amounts, the x-ray, if it is an irritant, should stimulate the growth of connective and epithelial tissue cells and embryonic cells and not affect so readily cells like those in the heart, the nervous system and the secretory glands; in large amounts it will destroy. If the x-ray has a stimulating action it should

produce directly such effects as augmentation or inhibition of the heart, facilitation in the reflex arc and an increase in the secretory response of the secretory glands.

When such a distinction is made between stimulation, depression and irritation and when we call to mind the action of x-rays on tissues (x-ray burn and x-ray cancer), and the special sensitiveness of tumor cells, embryonic and germinal cells to x-ray, we are inclined to be skeptical concerning the accuracy of the term "stimulative action of x-rays".

If it is granted that the primary effect of x-ray is irritation the following question arises: May not a possible improvement in the nutrition and growth of a gland cell produced by mild irritation lead secondarily to an increase in the secretory activity of the cell? In the first place, it is a well recognized biological principle that a specialized cell cannot grow and perform a specialized function at the same time. Also, hyperplasia does not necessarily mean hypersecretion. Also, if a gland cell is functioning normally, it necessarily follows that its nourishment is normal and an improvement in its nourishment then would be of no physiological value. But, on the other hand, if a gland cell is not functioning normally, due to some disturbance of its nourishment, it might be possible to improve the nourishment of the cell by a "mildly irritant dose of x-ray." But, it is therapeutically obvious that such an improvement might have no practical or permanent effect unless the cause of the abnormal functioning of the cell is removed.

Theoretical discussion and generalization concerning the possible action of x-rays on glandular activity, however interesting, is fruitless unless supported by well controlled and thorough experimentation. Well controlled and thorough experimentation is especially indicated at this time on this problem because of its great physiological and therapeutic significance. We believe that we cannot emphasize too strongly the appeal that the experimentation be well controlled and interpretations and conclusions made with caution, for fear that this field of radiotherapy will be reduced to the same state as organotherapy in endocrinology.

### A CRITICAL REVIEW OF THE LITERATURE

**Adrenals:** The adrenals have been subjected to the action of x-rays in cases of hypertension for the reduction

\* Read at the Midyear Meeting of the Radiological Society of North America, St. Louis, May 19, 1922. A preliminary report of this work was made before the Radiological Society of North America, at Chicago, December, 1922.

of the blood pressure and in cases of diabetes to reduce the hyperglycemia and glycosuria.

Quadroni<sup>(8)</sup>, Sergent and Cottenot<sup>(9)</sup> and Zimmer and Cottenot<sup>(10)</sup> report a fall in blood pressure of from 10 to 70 mm. Hg following rather intensive radiation of the adrenals. Groedel<sup>(11)</sup> and Levy-Dorn and Weinstein<sup>(12)</sup> report no change in blood pressure following radiation of the adrenals. Stephan<sup>(5)</sup> irradiated the kidney region in a case of vasomotor paresis, hypotension and anuria, administering ten per cent of an erythema dose, and he reports that the blood pressure was raised to 130 mm. Hg. Levy-Dorn and Weinstein<sup>(12)</sup> failed to confirm Stephan and they suggest that the results of the various authors may be explained by psychic influences and lack of properly controlled experiments.

From the recent extensive work of Stewart and Rogoff<sup>(13)</sup> on the adrenals we doubt that blood pressure could be raised by irradiation of the adrenals with small doses of x-ray, because the resulting liberation of epinephrin, if it occurred, would not be sufficient to cause such a rise in blood pressure as reported by Stephan. We also doubt that blood pressure was lowered as a result of the irradiation as reported by two of the above authors because such a result would be fatal, since a fall in blood pressure occurs only secondary to asthenia following complete adrenalectomy, which results in death in higher mammals. Further, Stewart and Rogoff have shown that in 20 per cent of rabbits operated the entire adrenal tissue can be removed, due to accessory adrenal cortical tissue, without any alteration of their blood pressure or disturbance of their normal state of well being. This demonstrates that the adrenals are not directly related to blood pressure and the medulla, which produces epinephrin, is not necessary for life and good health.

Eisler and Hirsch<sup>(14)</sup> after killing rats by raying their adrenals with from 150 to 200 Kienboeck units, studied the epinephrine content of their adrenals by the blood pressure method and found it reduced. Such a finding is not surprising, in view of the histological findings of Decastello<sup>(15)</sup>, Zimmer and Cottenot,<sup>(10, 16)</sup> and most recently Grabfield and Squier<sup>(17)</sup> following intensive irradiation of the adrenals. These investigators report hemorrhages in the cortex and medulla, cell destruction and localized round cell infiltration in the cortex.

Dresel,<sup>(18)</sup> working on the basis of the Falta-Rudiger theory of diabetes, irradiated the adrenals of three diabetic patients, intensively, to suppress their action on the liver (according to the

theory) and reports a reduction in the blood and urine sugar. He says, however, that he is not able to draw any conclusions from the observations on his three patients. Zimmer and Cottenot<sup>(10)</sup> report a case of diabetes in which the adrenals were intensively irradiated to reduce blood pressure and the glycosuria was increased. It is, it seems to us, impossible to radiate the adrenals without including some of the pancreas. But Dresel used rather intensive treatment, and, therefore, one cannot claim that the pancreas was stimulated in his cases.

*Stomach:* Regaud, Mozier and Lacassagne<sup>(19)</sup> report that the glands of the fundic portion of the stomach are highly sensitive to the effects of radiation, the parietal cells being less sensitive than the chief cells. Winternitz<sup>(20)</sup> reports that radium, even in relatively large doses in radio-active water (4000 Mache-Einheit to 400,000 Volt-Abfalleinheiten) has no influence on gastric secretion. Bruegel,<sup>(21)</sup> with relatively intense irradiation of the stomach in cases of hyperacidity, reports a reduction of the acidity of the gastric secretion, but in cases of hypoacidity and anacidity he was unable to augment the acid values. He does not report the "Reizdosen" used. Szego and Rother<sup>(22)</sup> report that only when using a dose greater than an erythema dose were they able to observe evidence of irritation which was followed by depression of gastric secretion. They have not published their data or protocols. Wilms<sup>(23)</sup> reports the satisfactory use of x-rays for the reduction of gastric acidity. Stephan<sup>(5)</sup> reports improvement in a case of achylia gastrica when the stomach was irradiated with a sub-erythema dose. Bryan and Dormody<sup>(24)</sup> report two cases of hyperacidity in which the patients show almost an immediate reduction in gastric acidity following 25 to 35 ma. min., 80 kv. at 10 inches. This dose was administered from three to four times within one month.

So the literature presents ample evidence to prove that the acidity of gastric secretion can be reduced with fairly intensive irradiation of the stomach. Whether or not such a procedure is good therapeutics from the standpoint of the stomach is a question for future experimentation to answer.

The evidence pertaining to increasing the acidity of gastric secretion in cases of hypoacidity and anacidity is very meager and highly questionable so far as its significance is concerned.

*Kidneys:* Much work has been done to determine what is the effect of x-rays on the kidneys. A large group of investigators<sup>(25-31)</sup> have found evidence of "x-ray nephritis" after intensive

radiation. Other workers<sup>(32, 33, 34)</sup> claim that the kidney is very resistant to x-rays and that there is no such clinical entity as "x-ray nephritis." More recently McQuarrie and Whipple<sup>(35)</sup> report negative results on the production of x-ray nephritis and conclude that "moderate doses of x-rays given repeatedly over considerable periods of time have no influence on renal function or renal structure" and that "large doses of x-rays given directly over the kidney may cause a slight but distinct lowering of renal function which lasts a few days" without "any corresponding histological change."

Stephan<sup>(5)</sup> claims to have cured anuria and to have caused diuresis in twenty-four hours in three cases of nephritis by using one-sixth to one-seventh of an erythema dose. Petersen and Saelhof<sup>(36)</sup> report stimulation of renal activity following a small dose of x-rays in a few dogs under very violent experimental injury of the kidney. These cases and experiments, we are of the opinion, are barely suggestive and are not at all convincing.

*Pancreas:* Ascoli and Faginoli<sup>(37)</sup> treated three cases of diabetes by irradiation of the pancreas. Results were negative. Zimmer and Cottenot<sup>(10)</sup> report increase in the glycosuria in a case of diabetes after intensive irradiation of the adrenal region. Dresel<sup>(18)</sup> reports a decrease in the glycosuria and hyperglycemia in three cases of diabetes after rather intensive irradiation of the adrenal region, but states that his results are not conclusive. Falta<sup>(38)</sup> says that the general metabolism may be stimulated and glycosuria of a diabetic patient increased when treated with radium emanations. Stephan<sup>(10)</sup> treated two cases of diabetes with sub-erythema doses of x-ray and reports an improvement in their condition. Both of his patients, however, were on a restricted carbohydrate diet. Petersen and Saelhof<sup>(39)</sup> irradiated the pancreas region of five partially depancreatized dogs (diabetes levis), using 6 in. spark, 3 mm. Al, 5 ma., 10 in. focal distance, time, ten minutes, and report a more or less transient improvement in the glycosuria and hyperglycemia.

Since both of Stephan's cases were on a restricted carbohydrate diet and since the improvement reported is not marked, we are not inclined to view his results enthusiastically. And, since Jensen and Carlson<sup>(40)</sup> state from their physiological studies of partially depancreatized dogs that "one cannot predict the metabolic course of any one animal deprived of approximately seven-eighths of the pancreas," and that the question of their metabolic course on restricted carbohydrate diet "can be settled by the statistical method only,



using a great many animals for the work," and since Peterson and Saelhof report no control animals and worked on only a few animals, we are of the opinion that their results do not prove that small doses of x-rays stimulate the functioning of the pancreatic remnant.

**Hypophysis:** Stettner<sup>(41)</sup> reports two patients afflicted with dwarfism in which irradiation of the hypophysis with sub-erythema doses caused an increased growth in the skeleton, equal to that of two and one-half years, within a period of from 86 to 138 days. In one case he also irradiated the parotid with sub-erythema doses because of chronic parotitis. The dwarfism in the second case was complicated by epulis, for which operation was performed, and status lymphaticus. The x-rays in this second case were administered in the left cervical region and the author states that some of the x-rays probably struck the hypophysis. Fraenkel<sup>(42)</sup> irradiated the hypophysis in osteomalacia with small doses of x-ray and secured good results. Ascoli and Faginoli<sup>(37)</sup> irradiated the hypophysis in one case of dystrophia adiposa genitalis, in one case of scleroderma and in five cases of asthma and obtained gratifying results from small doses of x-ray.

**Thymus:** The action of x-ray on the persistent thymus is well known and established. Fraenkel<sup>(42)</sup> irradiated the thymus, with small doses of x-ray, in a case of osteomalacia. Brock<sup>(43)</sup> reports improvement in psoriasis by irradiation of the thymus with small doses of x-ray.

**Gonads:** The destructive action of x-ray on the germinal epithelium has been known for some time and is frequently used therapeutically. Fraenkel<sup>(42)</sup> has irradiated the ovaries with small doses of x-rays in certain forms of dysmenorrhea and amenorrhea with improvement in the condition of the patient.

**Spleen:** The destructive action of x-rays on the cells of the spleen is well known.

Stephan<sup>(44, 45)</sup> offers evidence which he interprets as demonstrating that deep roentgenotherapy applied to the spleen stimulates the spleen specifically to form coagulating ferment. He reports some very striking cases in which the x-rays were used to hasten coagulation in cases of intractable hemorrhage. Neuffer<sup>(48)</sup> confirms Stephan's clinical observations. Szenes<sup>(46)</sup> reports that blood clots more readily after irradiation of lymphatic tissues in general. Saelhoff<sup>(47)</sup> reports that irradiation (5 in. back spark, 4 mm. Al, 8 ma., 10 in. focal distance, time, ten minutes) of the splenic, hepatic and intestinal areas made the blood more coagulable. Foster and Whipple<sup>(48)</sup> report a rise in fibrin

values after irradiation of the intestinal and thoracic areas (350 ma. min.) and state that "any cell injury in the body, with or without any inflammatory reaction, will cause this characteristic reaction with prompt rise in blood fibrinogen values."

The consensus of opinion and weight of the evidence seems to be that the effect of x-ray on coagulation is not a specific stimulation effect, but is due to a tissue injury.

**Lymph Glands:** It is generally known and agreed that a dose slightly more than an erythema dose, if repeated four or five times within a period of two months, will cause an atrophy of lymphoid tissues.

Murphy<sup>(50)</sup> reports that large doses of x-rays cause a diminution, and small doses an increase of circulating lymphocytes. This was confirmed by Thomas, Taylor and Witherbee<sup>(51)</sup> but Mottram and Russ<sup>(52)</sup> who have done much work on the biological action of x-rays, show that if the above investigators had made blood counts soon after x-ray exposure, that is, one hour after, they would have observed a lymphopenia when small doses of x-rays were used. In other words, even with small doses of x-rays a lymphopenia precedes the lymphocytosis, the latter being a physiological reaction to the lymphopenia. Mottram and Russ suggest further that the terms, "destroying and stimulating doses," used by Murphy, may prove misleading, for they are apt to give the impression that essentially different effects are observed after short and prolonged exposure to x-rays."

#### SUMMARY

With the exception of the germinal epithelium of the gonads, glandular epithelium is quite resistant to the effects of x-rays. The literature presents

worthy evidence that the glandular activity of some of the glands can be decreased. The dosage of x-rays required in each instance has not been accurately determined. As to stimulation of glandular activity by small doses of x-rays, we are of the opinion that the literature suggests the possibility of such, but that it has not been demonstrated as yet in a single instance.

#### PART II.

#### STUDIES ON THE EFFECT OF X-RAYS ON GLANDULAR ACTIVITY

##### THE SUBMAXILLARY GLAND

In the preliminary report of our work on this subject<sup>(53)</sup> we have referred to certain criteria that must be followed, where the physiology of the gland will permit, in order to make work on this subject accurate. We have also given explanatory reasons why we have selected the submaxillary gland as the first gland for study in our series of studies.

So far as we are able to find from a review of the literature, Horowitz<sup>(54)</sup> has been the only investigator who has studied the effect of radioactivity on the submaxillary gland. He concludes from his observations, which were wholly histological, that the submaxillary gland tissue is not very sensitive to radioactivity.

#### METHODS

Our experimental methods may be classified as acute and chronic, the acute experiments lasting from three to five hours, the chronic from one to nine months.

**Acute Experiments:** The methods used in our acute experiments have been described in sufficient detail in the preliminary report.<sup>(53)</sup>

**Chronic Experiments:** The chronic experiments have been performed on dogs with a Wharton's duct fistula.

Table I

Effect of Prolonged Experimentation upon the Blood Volume Flow and Secretory Response of the Submaxillary Gland. Dog: Acute Experiment.

PROCEDURE	Saliva in drops on stim. of Chorda	Volume Blood Flow in c.c. per min.		REMARKS
		Before stim. of Chorda	After Stim. of Chorda	
At Beginning of Experiment	54 gtt.	1.4 cc	5.8 cc	
1/2 hr. later	44	1.5	6.4	
1 hr.	31	1.4	5.2	
2 hr.	40	1.4	4.0	26% reduction in saliva 31% " " post-stim. flow

Chorda stim. 10 sec. with same current every 15 minutes.

(53-5) The method for the quantitative collection of the saliva has also been described. (53)

Six dogs with salivary fistula have been prepared and studied. The continuous secretion and the salivary response to standard stimuli have been determined and studied before and after various x-ray exposures. The standard stimuli were as follows: (1) The response to 0.5 per cent HCl solution applied to the oral mucosa for one minute was determined. The saliva was collected for one and a half minutes from the time the acid solution was first applied. The acid solution was applied by means of a forceps and a cotton sponge. The cotton sponge was approximately constant in size and ap-

plications of the acid solution were made ten times during the minute of application. So the amount of acid solution applied, the strength of the acid solution and the amount of oral mucosa brought into contact with the solution was constant. It will be noticed from the tables that the amount of salivary response is not constant, which is due to physiological variation. This means that only those averages and variations above or below the maximum and minimum are to be interpreted in drawing conclusions. (2) The response to two minutes eating of roast beef salted to taste was determined. Its dryness and saltiness was kept as near constant as possible because these are factors which influence salivary re-

sponse. (55) Here again the normal physiological variation in the secretory response was noted. (3) The response to the hypodermic injection of five milligrams of pilocarpin hydrochloride was determined. The injections were made in all instances into the loose subcutaneous connective tissue of the posterior thoracic region on either side. The latent period before the gland showed stimulation was noted and the secretion during the first five minutes of stimulation was collected separately and then the secretion for the next thirty minutes was collected. This differential collection was made in order to detect if there might be a change, not only in the total response of the gland, but also in the rate of response or sensitiveness of the gland when stimulated by pilocarpin. The response of the gland to pilocarpin was quite constant unless the animal vomited.

Chemical determinations of total solids, inorganic and organic solids were made on practically every quantity of secretion collected.

Viscosity was determined by an Ostwald pipette, the pipette being standardized against redistilled water. Six seconds was the time required for redistilled water to flow from the pipette when in the vertical position.

Determinations of pH were made by the colorimetric method, using phenol-sulphonphthalein as an indicator.

The salivary diastase was determined; it is well known that only traces are present in the saliva of the dog, these traces being probably only a filtrate from the blood.

#### X-RAY DOSAGES USED

In some of our work we used chiefly three doses of x-ray and for brevity we will refer to them as Dose I, II, and III. In other parts of our work we used varying doses, and when we refer to this we will give in detail the doses used.

Dose I consisted of 50 kv. max., 5 ma., 30 cm. focal distance, portal of entry 6 cm. in diameter, 10 min. exposure and no filter.

Dose II consisted of 100 kv. max., and the "set up" as in Dose I.

Dose III consisted of 145 kv. max., and the "set up" as in Dose I.

#### RESULTS

##### Immediate Effects of X-ray on the Secretory Activity of the Submaxillary Gland

**Acute Experiments:** Since in the course of our experiments it was necessary to keep the animal under light anesthesia for from two to three hours, it was necessary that some controls be run to see what effect prolonged experimentation itself might have on the secretory response and blood volume flow of the submaxillary gland. Such

Table II

Immediate Effects of Large Dose of X-rays on the Secretory Activity of the Submaxillary Gland. Dog: Acute Experiment X.

Procedure #	Saliva in gtt.		Total Solids		Inorganic Solids		Organic Solids		Remarks
	Non-rayed Gland	Rayed Gland	Non-rayed Gland	Rayed Gland	Non-rayed Gland	Rayed Gland	Non-rayed Gland	Rayed Gland	
Normal Response. Control	39	48	1.07	1.07	0.33	0.17	0.74	0.89	Most active gland treated
After X-ray 50 K.V.-3 ma-10 min.	28	40							
After X-ray 75 K.V.-3 ma-10 min.	20	33							
After X-ray 80 K.V.-5 ma-10 min.	14	25							
After X-ray 110 K.V.-5 ma-10 min.	12	20							
After X-ray 110 K.V.-9.5 ma-10 min.	17	18							Increased Stim. Slightly.
Repeated Stim. with a 25% stronger Stim. Current	28	26							25% ma-min
After X-ray 110 K.V.-9.5 ma-10 min.	32	10	0.73	0.85	0.31	0.18	0.42	0.67	350 ma-min

# Focal distance 30 cm.; portal diameter 6 cm.; 10 minute rest between each exposure.

Note that the gland was not stimulated nor sensitized by the first dose. Pilocarpin was injected in one case following extensive exposure with the result that the x-rayed gland only yielded 75 per cent as much saliva as the non-rayed gland.

Table III

Effect of X-rays on Blood Volume Flow and Secretory Response of The Submaxillary Gland.

Procedure	Non-rayed Gland		Rayed Gland		REMARKS
	Saliva gtt.	Blood gtt.	Saliva gtt.	Blood gtt.	
Normal at beginning of Expt.	52		41	1.6 cc 5.6 cc	
Immediately after 1st X-ray Dosage	53 (12 min)		20		No stimulation No sensitization
Immediately after 2nd X-ray Dosage	55 (42 min)		21	1.2 cc 4.25 cc	Blood flow:-
Immediately after 3rd X-ray Dosage	25 (1½ hr)		11	.7 cc 3.4 cc	56% reduction of contin. 40% reduction of post stim. flow

First X-ray Dosage: Dose I and repeated before second x-ray.  
Second " " " Dose II and repeated before third x-ray.  
Third " " " Dose III and repeated before last stimulation.

Total 300 ma. min. within a period of two hours.

a study has been made by Gesell<sup>(56)</sup> but we thought it worth while to run such a control under our own experimental conditions.

Table I shows that prolonged experimentation under our experimental conditions causes a 26 per cent reduction in the secretory response of the gland, no reduction in the continuous volume flow of blood through the gland, and a 31 per cent reduction in the post-stimulation volume flow of blood through the gland when the chorda tympani nerve is stimulated for ten seconds every fifteen minutes for two hours. In three hours time the reduction in the secretory response may be as great as 50 per cent, as is shown in Tables II and III.

This effect of prolonged experimentation shows that it is necessary to run both glands at the same time, using one as a control and x-raying the other. This we have done in practically every instance, irradiating the most physiologically active gland in order to make our results more significant.

*Do small doses of x-ray stimulate secretion or sensitize the gland to nervous stimulation when the animal is under acute experimentation?* If small doses stimulate, there should be an augmentation in the flow of the continuous secretion. If small doses sensitize the gland to nervous stimulation there should be a greater than normal response when the chorda tympani nerve (the secretory and vasodilator nerve) is stimulated.

Our tracings show the number of drops of saliva produced by the continuous secretion of the gland in seven dogs to be from none to two drops per minute. Dose I, or a dose the same as Dose I with three ma. for five minutes or for ten minutes, does not produce an augmentation in the flow of the continuous secretion. These doses are alleged "stimulating doses."

Table II and Figure 1 show that small doses of x-ray do not sensitize the gland to nervous stimulation and that large doses of x-ray under acute experimentation reduce the response of the gland to nervous stimulation. From 250 to 350 ma. minutes with gradual increase in the kilovoltage (see table) is required to produce this effect.

Pilocarpin was injected in one experiment following the administration of 300 ma. minutes according to the plan shown in Table II with the result that the treated gland only yielded 75 per cent as much saliva as the non-treated gland.

The results of chemical analyses of the saliva collected during the acute experiments varied too widely to be of much significance. Table II shows the change in the chemical nature of the

secretion as it occurred in that experiment. A reduction in total solids occurred, which is for the greater part ac-

counted for by a decrease in the organic solids, as is to be expected. The reduction in total solids occurred in about

Table IV

Immediate Effects of Large Dose of X-rays on the Secretory Activity of the Submaxillary Gland in a Dog with a Wharton's Duct Fistula.

Procedure	Amount in cc	Viscosity in seconds	Total Solids %	Inorganic Solids %	Organic Solids %	Remarks
0.5% HCl Stimulation before X-ray treatment: Control.	4.8	13	0.9418	0.4734	0.4684	
Continuous Secretion during X-ray treatment of 15 min. Dose III.	.45		0.8071	0.1195	0.6876	
0.5% HCl Stimulation immediately after X-ray	3.2	17	0.9380	0.3262	0.6118	One and half min. interval
Continuous secretion during X-ray treatment of 15 min. Dose III.	.35		0.5622	0.0749	0.4873	
0.5% HCl stimulation immediately after X-ray	4.7	13	0.9795	0.3298	0.6497	
Continuous secretion after acid stimulation without x-ray	.6		0.7247	0.0966	0.6281	
Pilocarpin stimulation 5 mg. One and one-half hr. after X-ray	4.2	7	0.3766	0.0853	0.2913	Normal response #

#Normal response, 6 cc; viscosity, 23 seconds; chemical constituents reduced from 50 to 60 per cent.

Table V

Effect of X-rays on the Secretion of the Submaxillary Gland of the Dog: Fistula of Wharton's Duct. Dog 1.

Procedure	Amount of Saliva in c.c.			Viscosity of Saliva *			P.H. of Saliva	Remarks
	Max.	Min.	Avg.	Max.	Min.	Avg.		
Controls before X-ray								
15 minutes continuous secretion	0.3	0.0	0.1					
5% HCl Stimulation 1 minute	4.2	2.0	3.4	30"	12"	19"		
Meat Stimulation 2 minutes	3.5	2.0	3.0	12'	2'-30"	9'		
Pilocarpin Stimulation 5 minutes collection	7.0	5.0	6.0	30"	18"	24"		
Pilocarpin Stimulation 35 minutes collection	30.0	23.0	25.0			2'		
1 month # after X-ray								
15 minutes continuous secretion	0.2	0.0	0.05					
5% HCl Stimulation 1 minute	4.0	2.7	3.3	16"	14"	15"		
Meat Stimulation 2 minutes	2.8	1.6	2.0	2'20"	11'45"	2'		
Pilocarpin Stimulation 5 minutes collection	2.0	1.5	1.8	20"	13"	16"		
Pilocarpin Stimulation 35 minutes collection	10.0	6.0	7.5			20"		

\*Viscosity measured with an Ostwald pipette.

# 1st effects noticed 7 da. after 1 dose of Dose III.

Average taken from six to ten experiments.

Dosage: Six doses each of I and II, and two doses of III within 30 days.



one-half of our experiments, while in the others the opposite occurred, but the change was still accounted for by a change in the organic solids. The viscosity was increased or reduced as the organic solids were increased or reduced. In our experiments in which the total solids were increased, the increase was greater in the treated gland than in the non-treated gland. When a decrease occurred in the total solids the decrease was greater in the non-treated gland than in the treated. So in the acute experiments the organic constituents of the secretion were more subject to the influence of the x-ray than the inorganic.

*What is the immediate effect of x-ray on the blood volume flow of the gland?* The small doses of x-ray, although unfiltered rays were playing directly on the gland tissue, had no effect on the blood volume flow. Large doses (300 ma.

min.), Table III, had an apparent vasoconstrictor action on the blood vessels in that blood volume flow was decreased more than in a normal control (Table I.)

We believe, however, that this reduction in blood volume flow is not to be interpreted as due to vasoconstriction, but as due to a passive hyperemia. The reduction in the blood volume flow of the continuous flow causes us to make this interpretation of our results. We do not deny that this observation might be an artefact and we intend to do further work on this question. But, in view of the observations of Halkin<sup>(57)</sup> and Thies<sup>(58)</sup> that show that the x-ray causes a loss of tone of the wall and a swelling of the endothelium of the blood vessels, occurring twenty-four hours after exposure, and in view of our own observation on the effect of large doses of x-ray on the blood ves-

sels of the ear of the rabbit and cat, we think that our interpretation is warranted.

*Chronic Experiments: What is the effect of small doses of x-ray on the continuous secretion of the gland with fistula of its duct?* The continuous secretion of seven submaxillary glands with a fistula of Wharton's duct varied from 0.1 c.c. to 0.5 c.c. in fifteen minutes. We have subjected the glands to the following exposures of x-ray: 40 kv. max., 3 ma., 30 cm. focal distance, 6 cm. diameter portal of entry, no filter, for five and ten minutes; also to Doses I, II and III for ten minutes. Following these exposures we have not observed, even in a single instance, either an immediate, transient or permanent increase in the continuous secretion. The animals must not be allowed to lick the nose as that causes an augmentation of the continuous secretion. The dogs were trained to lie quietly while the treatments were given.

We have constantly made the observation that while the animals are being subjected to large doses of x-ray (Dose III for ten, fifteen or twenty minutes) never more than one or two drops of saliva would flow from the fistula, even though during the ten or fifteen minute period prior to the exposure from 0.1 to 0.3 c.c. of saliva was collected. This observation may be due to a psychic inhibitory phenomenon (xerostomia), because as soon as the dogs were put back into the stock the continuous secretion returned to normal, but was not greater than normal.

*Do small doses of x-ray sensitize the gland to reflex or direct stimulation?* Even though small doses of x-rays have no effect on the continuous secretion of the submaxillary gland, it is possible that the gland might be rendered more sensitive to reflex or direct stimulation.

In order to answer this question we made from six to twelve control observations in dogs having a Wharton's duct fistula. These observations extended over a period of from four to six weeks and took note of the response of the gland when stimulated reflexly by acid application to the oral mucosa and by the eating of meat, and when stimulated directly by pilocarpin, which acts on the postganglionic autonomic nerve endings in the gland. The large number of control observations were made in order to definitely ascertain the normal physiological variations of the gland in response to stimuli, thereby obviating any misconstruction of results following the radiation of the gland. We then treated the gland with x-ray, making observations immediately following treatment, and at intervals of from two to three days for a period of two weeks. Following Dose I no change

Table VI

Showing Effect of X-ray on Secretion of the Submaxillary Gland Two Months after Last Exposure and Showing no Effect of Secondary Radiation on the Non-rayed Gland.

Dog 1

Procedure	Saliva Amount in cc.	Visc'ty in Seconds	Total Solids %	Inorganic Solids %	Organic Solids %
<b>Left Gland Before X-ray</b>					
Acid Stimulation	3.4	19"	1.0696	0.5698	0.5001
Meat Stimulation	3.0	9"	2.0782	0.3512	1.7436
Pilocarpin 5 min.	6.0	24"	0.6799	0.4763	0.4036
Pilocarpin 35 min.	25.0	2"			
<b>Left Gland After X-ray - 2 months</b>					
Acid Stimulation	1.7	1"	1.5957	0.5036	1.0921
Meat Stimulation	1.3	8"	2.1793	0.5879	1.5914
Pilocarpin 5 min.	1.3	50"	0.9772	0.3873	0.5899
Pilocarpin 35 min.	7.6	20"			
<b>Right Gland Non-rayed control</b>					
Acid Stimulation	3.3	25	1.2180	0.6824	0.5756
Meat Stimulation	3.9	6"	2.2060	0.4331	1.7290
Pilocarpin 5 min.	7.0	1"	1.1780	0.5678	0.6102
Pilocarpin 35 min.	24.0	3"			

The figures are averages of from six to ten experiments.

Left gland was given six doses each of Dose I and II, and two doses of Dose III within a period of four weeks.

Table VII

Showing Progressive Differential Effects of X-ray on the Secretion of the Submaxillary Gland.

Dog 6

Procedure	Saliva Amount in cc.	Viscosity in Seconds	Total Solids %	Inorganic Solids %	Organic Solids %
<b>Gland before X-ray</b>					
Acid Stimulation	3.9	16"	1.149	0.536	0.613
Meat Stimulation	3.5	8"	2.016	0.565	1.451
Pilocarpin 5 min.	6.8	20"	.990	0.523	0.467
Pilocarpin 35 min.	31.0	1'10"			Latent period 3 1/2 min
<b>Gland 2 weeks after last treatment</b>					
Acid Stimulation	3.8	45"	1.532	0.185	1.346
Meat Stimulation	1.5	1'15"	1.440	0.246	1.193
Pilocarpin 5 min.	6.0	30"	1.040	0.323	0.927
Pilocarpin 35 min.	21.0	3"			Latent period 5 min
<b>Gland 7 weeks after last treatment</b>					
Acid Stimulation	0.2				
Meat Stimulation	0.1				
Pilocarpin 5 min.	1.0		No determination made		Latent period 9 min
Pilocarpin 35 min.	3.5	2'15"			

X-ray dosage: 6 exposures of dose I and 8 exposures of dose II within a period of two months. First effect noted two weeks after the last exposure. Figures are averages of from four to eight experiments.

in the response of the gland was noted. No immediate change occurred in the response of the gland when Doses II and III were used. The permanent effects will be referred to presently.

*What is the immediate effect of large doses of x-ray on the secretory response of the gland?* Because we obtained evidence of the immediate suppressive action of large doses of x-ray on the response of the gland in our acute experiments, we were of the opinion that the same effects could be demonstrated on the dog with a Wharton's duct fistula. However, Table IV shows that no immediate effect occurs, except possibly in the case of stimulation by pilocarpin. On another dog we tried a still larger dose (110 kv. max., 10 ma., 10 in. focal distance, 6 cm. diameter portal of entry, 1 mm. Al filter, time, thirty-three minutes) without observing any immediate effects. In this experiment acid stimulation was used. Immediately before x-ray exposure the gland secreted 3.5 c.c. of saliva and immediately after x-ray 3.7 c.c., which is well within the normal physiological variation of the secretory response of the gland to acid stimulation.

#### HISTOLOGY OF IMMEDIATE EFFECTS OF LARGE DOSES OF X-RAYS

We have made histological studies of the x-rayed gland when compared to the gland on the other side which had not been radiated. The glands were removed immediately following the experiment. The usual hematoxylin and eosin staining technique was used. We have been unable to observe any evidences of histological change immediately following relatively large doses of x-ray. We hoped to be able to find evidence of passive hyperemia and swelling of the endothelium of the blood vessels, but with the technique we have used up to date, we have been unable to demonstrate such changes.

#### DELAYED AND PERMANENT EFFECTS OF X-RAY ON THE SECRETORY ACTIVITY OF THE SUBMAXILLARY GLAND.

*Chronic Experiments on Wharton's Duct Fistula Dogs: What is the effect of the fistula per se on the secretory activity of the gland?* It is possible that the abnormal position of the papilla of the duct (transplanted from the mouth to the submental region) might have some effect on the secretory activity of the gland. In order to answer this question, we followed the continuous secretion and the secretory response of the gland to acid, meat and pilocarpin stimulation in two dogs which had had at that time a Wharton's duct fistula for a period of two and three months, respectively. We found that in these animals the secretion was influenced

neither quantitatively nor qualitatively.

*What is the delayed effect of x-ray on the continuous secretion of the submaxillary gland?* We have pointed out before that small doses have no effect, immediate or delayed, on the continuous secretion. Tables V and VI show the reduction in the continuous secretion one and two months following relatively large doses of x-ray. When one large dose (110 kv. max., 10 ma., 10 in. focal distance, 6 cm. diameter portal of entry, 1 mm. Al filter for thirty-three minutes) was given, a reduction was noticed seven days later. Hence, a reduction in the amount of continuous secretion occurs when large doses of x-ray are used.

*What is the delayed effect of x-ray on the secretory response of the gland*

*to reflex and direct stimulation?* This question is answered by the results shown in Tables V and VI. The effect of the rather intensive treatment is first observed from ten to fourteen days following the treatment and manifests itself by a differential depression in the secretory response of the gland to pilocarpin and to the chewing of meat, the secretion resulting from acid stimulation being normal in amount. The response to eating meat in all but one dog was the first to show reduction, generally from three to five days before the pilocarpin response was reduced. Table VI shows that after two months the response to acid stimulation is also markedly reduced.

That this suppression in the response of the gland was not due to a general

Table VIII

Showing Progressive Differential Effects of X-ray on the Secretion of the Submaxillary Gland. Using the Minimum Dose Necessary to Effect the Gland.

Procedure	Saliva Amount in cc.	Viscosity Amount in Seconds	
Before X-ray			
Acid Stimulation	3.3	25"	
Meat Stimulation	2.9	6"	
Pilocarpin 5 min.	7.0	1'	Latent period 4 min
Pilocarpin 35 min.	24.0	3'	
2 weeks after X-ray			
Acid Stimulation	3.4	23"	Effects first noted
Meat Stimulation	1.3	5"	on the 10th day
Pilocarpin 5 min.	2.3	3'35"	latent period 4 min.
Pilocarpin 35 min	17.5	50"	
4 weeks after X-ray			
Acid Stimulation	2.0	26"	
Meat Stimulation	1.5	1'58"	
Pilocarpin 5 min.	1.0	20"	latent period 6 min.
Pilocarpin 35 min.	9.0	4'15"	

X-ray Dosage: 110 kv. max.; 10 ma.; 35 cm. focal distance; 6 cm. diameter portal; 1 mm. Al filter; 40 minutes

Table IX

Showing No Effect of Small Dose of X-ray on Submaxillary Gland Suppressed with Atropin. Dog with Wharton's Duct Fistula.

Procedure	April 25th		May 5th X-ray	
	Saliva Amount in cc.	Viscosity in Seconds	Saliva Amount in cc.	Viscosity in Seconds
.5% HCl Stim. Control	3.6	45"	3.7	1'10"
Hypodermic Injection 1.2 mg Atropin Sulph.				
.5% HCl Stim. 10 min. after Inject.	0.5		0.6	
.5% HCl Stim. 1/2 hr. after Inject.	0.6	2'	0.6	1'50"
.5% HCl Stim. 1 hr. after Injection	1.2	1'50"	1.0	1'15"
.5% HCl Stim. 1 1/2 hr. after Inject.	1.4	1'20"	1.3	1'20"
.5% HCl Stim. 2 hr. after Injection	1.5	44"	1.7	1'10"
.5% HCl Stim. 2 1/2 hr. after Inject.	2.7	41"	2.4	45"
.5% HCl Stim. 3 hr. after Injection	2.8	40"	2.5	35"

\* Dose: 60 kv. max.; 3 ma.; 30 cm. focal distance; 6 cm. diameter portal, no filter; 10 min. Exposure given April 27th. Same response on April 27th and May 1st.

systemic effect is also shown by the results recorded in Table VI and by the observation that saliva flowed freely from the mouth, the source being from the non-rayed gland, when pilocarpin was injected, while but very little saliva was produced by the irradiated gland.

The normal latent period between the injection of pilocarpin and its effect on the gland varied normally from three to five minutes. After x-ray the latent period was increased to seven and eight minutes.

Table VIII shows the effect of what we have determined to be the minimum dose necessary to have any demonstrable influence on the secretory response of

the submaxillary gland in a normal dog with a Wharton's duct fistula.

THE IMMEDIATE OR DELAYED EFFECT OF SMALL DOSES OF X-RAY ON THE SECRETORY RESPONSE OF THE SUBMAXILLARY GLAND SUPPRESSED WITH ATROPIN.

Even though a small dose of x-ray has no stimulating effect on the normal gland, it is possible that such a dose may stimulate a gland that is suppressed or secreting below normal. In order to ascertain if such is the case we injected subcutaneously in a dog with a Wharton's duct fistula 1.2 mg. of atrophin sulphate, which was sufficient to suppress the secretion of the gland, but not to abolish it. We then stimulated the

gland reflexly by acid application to the oral mucosa at one-half hour intervals for three hours after the injection. We ran four control experiments prior to x-ray exposure of the gland, and then an experiment immediately after x-ray exposure and at intervals of three days for two weeks after exposure. Our results failed to demonstrate that the gland suppressed with atropin was sensitized or stimulated by exposure to small doses of x-ray either immediately or several days after exposure. We used three different doses of x-ray as follows: (1) 40 kv. max., 3 ma., 30 cm. focal distance, 6 cm. diameter portal of entry, no filter, five minutes; (2) 60 kv. max., 3 ma., 30 cm. focal distance, 6 cm. diameter portal, no filter, for ten minutes; (3) 110 kv. max., 10 ma., 30 cm. focal distance, 6 cm. diameter portal, no filter, ten minutes.

Table IX shows a typical result of no effect from the dosage in that series of experiments.

THE EFFECT OF RELATIVELY LARGE DOSES OF X-RAY ON THE COMPOSITION OF THE SALIVA.

Table IV shows that x-ray exposure causes no immediate change in the composition of the saliva in dogs having a Wharton's duct fistula, which has been verified by other experiments on other dogs.

On the delayed effects of x-ray on the composition of the saliva our results are variable, as shown in Tables VI, VII, X and XI. The most decided change in composition was in the case of the saliva produced by meat stimulation. All of our animals showed a reduction in the viscosity and total solids of the "meat saliva" within the first month. In all cases this reduction of total solids was about equally distributed between organic and inorganic solids, but in one case (Table XI) a reduction of organic solids alone occurred. We are unable to make any definite statements concerning any change in the composition of the "acid and pilocarpin salivas."

After a period of from two to three months after exposure the composition of the saliva returns to approximately normal (Table VI) or slightly above normal, which demonstrates that the gland cells not destroyed by the x-ray are functioning normally and that the permanent reduction in the quantity of the secretion is due to a destruction of gland cells, as is to be pointed out by the results of histological studies.

### PART III.

THE EFFECTS OF RELATIVELY LARGE DOSES OF X-RAY ON THE HISTOLOGY OF THE SUBMAXILLARY GLAND.

*Immediate or Acute Effects:* In all cases the non-irradiated gland from the

Table X  
Effect of X-rays on the Composition of the Secretion of the Submaxillary Gland of the Dog. Fistula of Wharton's Duct.

Procedure	Total Solids in percent			Inorganic Solids in percent			Organic Solids in percent		
	Max.	Min.	Avg.	Max.	Min.	Avg.	Max.	Min.	Avg.
Controls before X-ray									
15 minutes Continuous Secretion	1.724	0.833	1.327	0.515	0.140	0.305	1.264	0.543	1.006
.5% HCl Stimulation - 1 minute	1.341	0.723	1.016	0.585	0.293	0.404	0.839	0.338	0.608
Meat Stimulation * 2 minutes	2.306	1.912	2.109	0.490	0.303	0.419	2.000	1.421	1.691
Pilocarpin Stimulation 5 mg. 5 min.	1.228	0.663	0.907	0.495	0.334	0.416	0.768	0.309	0.491
1 Month after X-ray #									
15 minutes Continuous Secretion									
.5% HCl Stimulation 1 minute	0.979	0.664	0.880	0.473	0.152	0.320	0.649	0.468	0.560
Meat Stimulation 2 minutes	1.704	1.064	1.342	0.231	0.070	0.134	1.504	0.994	1.208
Pilocarpin Stimulation 5 mg. 5 min.	0.896	0.376	0.636	0.110	0.085	0.097	0.786	0.291	0.538

\* Dry roast beef was used. #Dog had six doses each of Doses I, II and III.

Average of from six to ten experiments.

Table XI

Effect of X-ray on the Composition of the Secretion of the Submaxillary Gland of the Dog. Dog with Fistula of Wharton's Duct.

Procedure	Total Solids	Inorganic Solids	Organic Solids
	% Average	% Average	% Average
Controls before X-ray			
Acid Stimulation	1.069	0.569	0.500
Meat Stimulation	2.078	0.351	1.727
Pilocarpin Stimulation 5 min	0.879	0.476	0.403
1 month after X-ray			
Acid Stimulation	1.193	0.329	0.864
Meat Stimulation	1.697	0.394	1.303
Pilocarpin Stimulation	0.770	0.231	0.539

Average of from six to ten experiments. Dosage: 6 doses each of doses I and II and two doses of III within a period of thirty days.



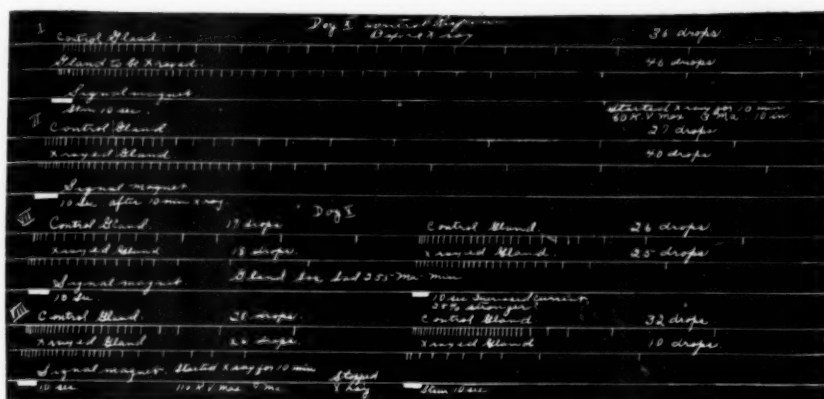


Fig. 1—A portion of the tracings from which the results in Table II were derived. Tracings show the effect of large doses of x-ray on the secretory activity of the submaxillary gland under acute experimentation.

same dog was compared with the irradiated gland. The usual hemotoxylin and eosin staining technique, using 10 per cent formalin, Zenker's and Bouin's fluids for fixation, was used. The glands of six dogs were studied, the dogs being those used in our acute experiments referred to in the first part of our paper. In every instance we were unable to notice any difference between the histological appearance of the irradiated and non-irradiated gland, even though we had in the course of our experiments shown a physiological difference between the two glands.

**Delayed and Permanent Effects:** The delayed histological changes are quite marked, as judged from our studies on four dogs. Here also we compared the irradiated gland with the non-irradiated control. The glands were removed fifteen days and two months following the manifestation of physiological disturbance of the function of the gland. At fifteen days the glands showed the following changes: (1) Infiltration of round cells about the secretory ducts, blood vessels and in the stroma of the gland; (2) a reduction in the amount of stored mucus in the cells of the alveoli with evidences

of degeneration of some of the gland cells; and (3) a proliferation of fibroblasts in the stroma of the gland. No hemorrhages or signs of previous hemorrhage were present. At two months the glands showed the following changes: (1) They were smaller in size than the normal control and more firm in consistency; (2) there was less round cell infiltration than was found in the glands studied at fifteen days; (3) the fibrous tissue stroma was markedly increased in amount, and (4) the cells of the alveoli were loaded with stored mucus.

These histological findings of the delayed effects of x-ray on the histology of the gland correspond with the changes in the physiology of the gland; for example, the reduction of the viscosity and total solids as well as quantity of the secretion during the first month and the returning to normal of the composition of the secretion with a permanent reduction in the quantity.

#### DISCUSSION

Some of our observations call for an explanation and a discussion.

It is to be recalled that in our acute experiments we observed a depression of the gland when irradiated with large

doses of x-ray, which did not occur in our experiments with the dogs having a Wharton's duct fistula. We can only explain this apparent discrepancy by assuming that in the acute experiments the gland was depressed or altered as a result of the effects of the ether and acute experimentation and hence a slight immediate depressive action of the x-ray was able to make itself evident.

It is interesting to note that following the large doses of x-ray we did not obtain a "paralytic secretion" as is observed when the chorda tympani nerve is sectioned. This demonstrates that the quantitative and qualitative change in the secretion after x-ray is most probably not due to any action of the x-ray on the chorda tympani.

We can best account for the differential depression of the secretory response that occurs during the first month by assuming that pilocarpin and meat stimulation are submaximal stimuli when compared with acid stimulation and therefore any depression of the secretory response would first become evident when submaximal stimuli were used.

The reduction in the quantity of the secretion is adequately explained by the histological changes in the gland after x-ray, the proliferation of fibroblasts, the increase in the connective tissue and the decrease in the glandular tissue of the gland which make it impossible for the gland to produce a normal amount of secretion.

The reduction of the total solids of the "meat secretion" during the first month shows that the gland cells themselves are affected by the x-ray and that they are not forming a secretion of normal consistency. This change is more evident for the "meat secretion" because of its concentration. That the gland cells are affected by the x-ray is further evidenced by their actual destruction and replacement by connective tissue cells, as pointed out before (Fig. 5).

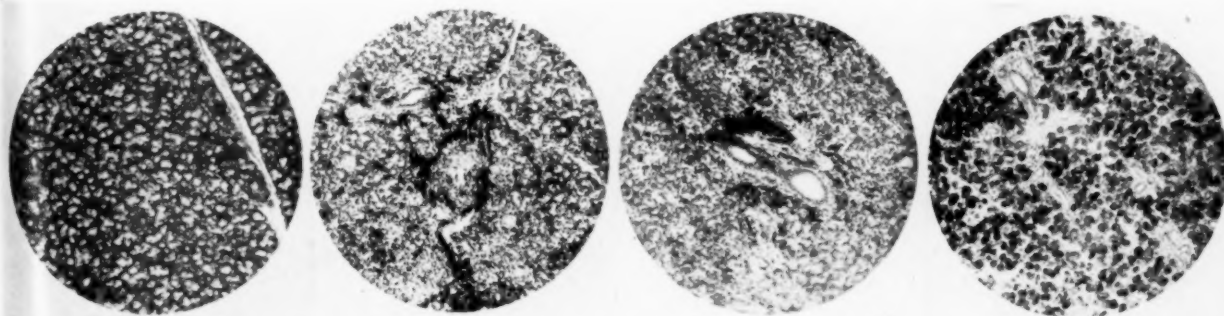


Fig. 2—A normal control gland from the same dog from which Figure 3 was taken. Magnification x 65.

Fig. 3—An irradiated gland removed fifteen days after manifestation of a physiological change, showing a sterile abscess surrounded by round cells which radiate off along the course of a blood vessel, other areas of round cell infiltration of the stroma and a reduction in the "stored mucus" and an increase in the amount of connective tissue stroma cells (fibroblasts). Magnification x 65.

Fig. 4—A high power view of an irradiated gland two months after manifestation of a physiological change, showing marked increase in fibrous tissue and the presence of "stored mucus" in the cells of the alveoli.

Fig. 5—An irradiated gland two months after manifestation of a physiological change showing marked increase in fibrous tissue and the presence of "stored mucus" in the cells of the alveoli.

Our observation on the effect of small doses of x-ray on the gland suppressed with atropin are interesting because they show that the continuous secretion of the suppressed gland is not augmented and that the gland cell is not sensitized to reflex stimulation. This argues against any therapeutic benefit of stimulating doses of x-ray in cases of xerostomia. It does not prove, however, that no beneficial results would occur, because the etiology of chronic xerostomia is not known and its etiology may not simulate atropin depression of the gland. We hope to be able to answer this question by exposing the salivary glands of such cases to x-ray.

It is interesting to note that our results demonstrate that the Witherbee dosage of x-rays for the treatment of hypertrophied tonsils will not injure the submaxillary gland.

#### SUMMARY

In acute experiments we were unable to demonstrate that small doses of x-ray stimulate or sensitize the submaxillary gland. Our results show that large doses of x-ray in acute experiments cause an immediate depression of the secretory activity of the gland which may be explained by an altered blood flow through the gland.

In dogs with a Wharton's duct fistula we were unable to demonstrate that small doses of x-ray stimulate or sensitize the submaxillary gland. Large doses of x-ray do not cause an immediate depression of the secretory activity of the gland, but a differential depression in secretory activity occurs which is first manifested from ten to fourteen days following the exposure of the gland.

One month after exposure, the gland manifests a depression to all stimuli used. An alteration in the composition of the saliva occurs. Two months after exposures the secretion remains markedly reduced in quantity, but its composition returns to normal. The depression is not due to any general systemic effect of the x-ray exposure.

Fistula of the duct of the gland does not alter its secretory activity.

The minimum dose required to produce depression of the secretory activity of the submaxillary gland is as follows: 110 kv. max., 10 ma., 25 cm. focal skin distance; portal of entry, 28 cm. square; 1 mm. Al filter; time, forty minutes.

The submaxillary gland partially suppressed with atropin is neither stimulated nor sensitized when exposed to small doses of x-ray.

The effect of large doses of x-ray on the histology of the submaxillary is reported.

*Note:* Results on the effects of x-ray on the secretory activity of the gastric



Fig. 6—The photograph demonstrates the method used in collecting the saliva from an animal with a Wharton's duct fistula. Attention is especially called to the glass funnel attached to the skin about the fistula with flexible celloidin, and to the glass test tube used for collecting the saliva. The tube is fastened to the funnel with wax.

glands were reported at the St. Louis meetings of the Radiological Society of North America. These results will be reported later in another paper.

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## Diaphragmatic Hernia--Non-Traumatic: With Report of Four Original Cases

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**DIAPHRAGMATIC** hernia caused by trauma is not rare. Congenital diaphragmatic hernia is quite infrequent. The clinical history can so simulate other diseases that unless hernia is thought of the patient will go through life with the true condition unknown. Symptoms may be few and not pressing, and such cases often are not detected.

My interest was aroused, when in a single year, I found three cases of hernia of the diaphragm with no known history of injury. In the following year I detected a fourth case with no known history of injury. Two of these patients were referred for a gastro-intestinal examination because of digestive disturbance, one was referred to confirm a pneumothorax and the fourth case was referred for an examination of the heart.

### ETIOLOGY

The causes of traumatic hernia are crushing injuries, gun shot wounds and injury of the diaphragm with the aspirating needle. Congenital hernia is probably due to an imperfect development.

### POSITION

The opening can be at any place in the diaphragm. In my four cases, two had an abnormally large opening for the esophagus. Two had openings through the dome of the diaphragm. Some reported cases have openings in the right and left diaphragm.

### SYMPTOMS

The abdomen may be contracted. Pains are usually in the lower left chest which will have a resonant note if the stomach is full of gas, and there will be absence of breath sounds over the left lower chest. Vomiting is not always present. There is distention and dyspnea, at times regurgitation of food, obstruction, and, if the hernia should become partially strangulated, there is shock. The chest will show no change in appearance.

The symptoms are those of interference with gastric function and em-

barrassment of respiration. The gastro-intestinal symptoms may be absent.

### LITERATURE

The literature is meager. In the May, 1920, issue of the American Journal of Roentgenology, Webster W. Belden, M.D., of General Hospital No. 41, says: "Prior to the great war, cases of hernia of the diaphragm, with either stomach or colon passing into the thoracic cavity, were decidedly rare. In fact, in 1908 the most recent text books did not even mention the images furnished by this type of lesion."

Foster, in the New York Medical Journal, Vol. 112, page 77, 1920, reports a case that he says would have remained a sealed book except for the postmortem examination. The patient, a young man 24 years old, was admitted to the hospital on account of severe indigestion. He said he had always had some trouble with the stomach and was subject to attacks of abdominal pains accompanied by nausea, but did not usually vomit. The case was regarded as chronic appendicitis. The particular attack which brought him to the hospital was similar to other attacks. The pains increased so that he soon was bordering on collapse. The temperature was normal and he was bathed in a cold sweat. The pains were localized over the left upper abdomen. Examination revealed a tympanic note over the left lower chest to the fifth rib in the axillary line. Over this area the breath sounds were absent. The diagnosis was pneumothorax. The patient did not rally and died within twenty-four hours.

The postmortem showed a diaphragmatic congenital hernia. The stomach and small intestines were in the thoracic cavity.

The British Medical Journal, Sept., 1919, reports a patient, a soldier, who suffered much pain after food of any kind and who was sick in the hospital much of the time. He was given medicines and duty, but with no improvement. Finally he was sent home as a case of gastritis. He again was hospitalized and this time because of a wound

on the abdomen and a corresponding wound on the back it was thought possible he might have an hour-glass stomach. Upon x-ray examination the greater part of the stomach was found to be in the chest cavity. This case, of course, is classed as traumatic hernia.

Richard Warren, M.D., in the Lancet, Jan. 21, 1919, says: "Hernia of the abdominal viscera through the diaphragm is tolerably rare, but is likely to be more common in the future, as the result of battle wounds."

The records of the East London Hospital show seven cases. Three were gun shot injuries of the belly and chest. One patient was injured in a buffer accident. Two cases, one 16 and one 30 years of age, gave no history of injury and were possibly due to congenital defects. Another case, a patient 68 years of age, with a long history of wastings and vomiting, but no note of injury, may also be congenital.

Alexander Stewart McMullen, M. D., Chief of X-ray Service U. S. General Hospital No. 1, in the American Journal of Roentgenology, March, 1920, says that among fifteen thousand cases examined in the x-ray laboratory of the hospital, three cases of hernia followed injury. The third case, however, is uncertain, as there was no direct history of injury, but the patient had had pneumonia in the left lung, lower lobe, with empyema following, and as drainage had been employed, there was a chance of an injury. It is of interest that the diagnosis in each case was made in the roentgen laboratory.

John E. Grieve, M. D., Archives of Pediatrics, October, 1920, reports a child five and one-half years old. He says "The history of her illness, in a sense, preceded her birth, inasmuch as the mother at the time of her delivery and immediately thereafter was severely ill with whooping cough. Immediately after birth the child was seized with attacks of coughing, which continued to the fifth year. This child had trouble with digestion, and vomiting was severe. Examination by the barium meal

\*—Read at the Annual Meeting of the Radiological Society of North America, Detroit, Dec. 6, 1922.



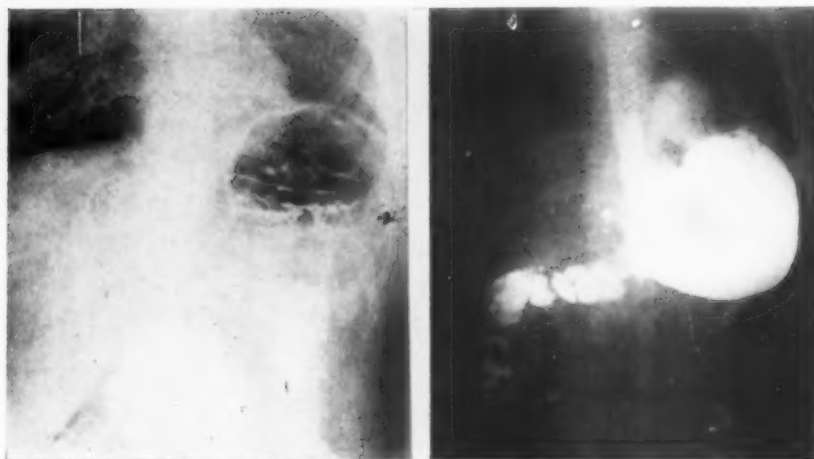


Fig. 1—(Case 1)—Mr. U.—Note air bell with streaks of barium. First impression is one of eventration.

Fig. 2—(Case 2)—Mr. C.—Irregular heart action and shortness of breath main symptoms. The plate is a twenty-four hour retest, some barium in the colon. Bulb not seen.

showed the stomach partially in the left chest. This case was likely not congenital, but caused by the exertions of the cough."

In the *Annals of Surgery*, April, 1921, Samuel Gitlow and Ben Breakstone report a patient, a widow, 65 years of age, whose chief complaint was dyspnea (left chest) that dated back many years. There was no history of injury. After all other attempts at diagnosis had been tried the x-ray revealed the stomach in the left chest.

In the *British Journal of Surgery*, October, 1921, M. Fitz Maurice-Kelley, relates a case of double congenital diaphragmatic hernia in a patient aged 35 years. The colon was involved. The pains came on suddenly and were followed by strangulation. This patient had suffered two attacks previously and had served two years in the war. Congenital hernia was reported at the post-mortem examination, because of the shape of the liver and the abdominal organs.

Louis Frank in the *Annals of Surgery*, Vol. 71, No. 3, 1920, reports a child 16 years old, who had had indigestion from infancy. Vomiting was a prominent symptom. The history was irregular with gain and loss in weight. Because of the symptoms an obstructed pylorus was thought of. A roentgen examination revealed the stomach in the chest.

L. Blumenfeld, *New York Medical Journal and Medical Record*, Aug. 2, 1922, reports the case of a newborn child which at birth gave a little gasp and a faint cry and made forced attempts at inspiration. Behrend tried all of the prescribed methods of artificial respiration, but none seemed to relieve the progressive and increasing asphyxia. The child was becoming

quite cyanotic and oxygen inhalations were given. As long as the child was kept in a basin of water at body temperature and supplied with oxygen the color remained good, but as soon as the oxygen was taken away the cyanosis returned. The efforts at inspiration gradually became weaker and less labored and the child died an hour and a half after birth. The only external physical defect present was a marked right talipes equinovarus and to a less degree a left talipes equinovarus. On opening the abdomen, the liver was found much enlarged and filling the greater part of the abdominal cavity. The only other visible content of the abdomen was the sigmoid. The descending colon disappeared through a slit in the diaphragm caused by the separation of the diaphragm from the posterior abdominal wall. The opening was about one-quarter of an inch to the left of the aorta. On removing the anterior chest wall the thorax was found filled with small intestines up to



Fig. 3—(Case 3)—Mr. R. G. D.—Shortness of breath with acute pains after eating or drinking. Quantity rather than quality determined severity of the attack. The stomach and bulb is distended but not yet emptying. The esophagus gives the impression of emptying into the bulb. The stomach would hold this position for minutes before the duodenum would fill.

the neck. It also contained the entire stomach and the large intestines.

J. S. Latta, *American Journal of Diseases of Children*, Chicago, October, 1922, cites a case in which there was an almost total deficiency of the left side of the diaphragm. Associated with and doubtless as a result of this, there were found some other minor anomalies, the most evident of which was a displacement of some of the abdominal viscera into the left pleural cavity. It was obvious that these misplaced viscera represented a spurious hernia, due to an arrest in development of the left side of the diaphragm, rather than a true hernia due to a lack of diaphragmatic muscular tonus or development, for these viscera were not enclosed in a hernial sac, but lay free in the pleural cavity.

C. M. Davis, *American Journal of Diseases of Children*, Chicago, October, 1922, cites the case of an infant which on the eighth day after birth had two transitory attacks of slight cyanosis with rapid breathing, for which examination revealed no cause. The following morning, shortly after nursing, the child suddenly became intensely cyanotic, with rapid dyspneic respiration, and lay limply in the dorsal position, with the appearance of impending death. The cyanosis was somewhat lessened by removing a rather snug abdominal band, and much more by holding the child in a vertical position, but it recurred promptly when the child was laid down. A diagnosis of left diaphragmatic hernia, due to congenital defect of the diaphragm was made and from the absence of vomiting and other gastro-intestinal symptoms, it was thought that the stomach was not involved in the hernia. This was confirmed by fluoroscopic and roentgenographic examination, which showed the stomach to be normal in appearance and position while all the intestines from the duodenum to the descending colon were above the diaphragm in the left chest and the heart was displaced into the right chest.

The following four cases were detected in my laboratory:

Case 1—Mr. U., 27 years of age, served two years in the late war. After his discharge, trying to establish a disability, he presented himself for examination. Shortness of breath and pains in the left lower chest were the main complaints. Pneumothorax had been diagnosed and he was referred to me to confirm findings. The patient stated that he had always been short of breath, which was most noticeable after eating heartily, and that a feeling of oppression in the epigastric region, sometimes amounting to pain, would follow a heavy meal. The same condition

was noticed after drinking more than an ordinary amount of fluid. The patient was well nourished. He had no scars on the belly or chest, and had never been injured, so far as he knew. The belly and chest were normal in contour. Breath sounds were absent over the left lower chest. The heart was slightly displaced to the right.

Fluoroscopic examination showed a domed outline which I thought was the diaphragm. The first impression was one of eventration. A stereoscopic set of plates showed a part of the fundus of the stomach above the diaphragm. In this case the opening through which the esophagus passes is enlarged and about one-half of the stomach is in the chest cavity.

Case 2—Mr. C., 29 years old, was referred for an examination of the chest, particularly of the heart. Heart action was found to be irregular during the periods of suffering and the breath short. Physical exertion and hearty meals always brought on pain. There was no known injury. The condition was marked in early life, so marked that the patient could not take part in the usual school games. Physical examination showed no external marks of violence. The belly and chest form was normal.

Fluoroscopic examination showed the heart displaced to the right and the air bell of the stomach above the diaphragm. Barium was given and part of the stomach was seen to be above the diaphragm. The opening in the diaphragm is about two inches from the esophageal opening. About one-fourth of the stomach is in the chest.

Case 3—Mr. R. G. D., 49 years old, was referred for a gastro-intestinal examination. Complaint had been of long duration, but for the past three years he had noticed that a feeling of fulness after meals was growing more pronounced. At times the pains were acute. Vomiting usually gave relief. What the patient ate mattered little, but the quantity would determine the acuteness of the attack. The color was good, but the weight had decreased about twenty pounds in the past three years. Shortness of breath was marked when pains were acute. The pain point was the pit of stomach.

The examination showed about one-half of the stomach above the diaphragm. The lower part of the stomach was the first to fill and if no more fluid was taken the upper sac remained empty. Taking more resulted in filling the upper sac and produced distress. In this case you will see an unusual arrangement of esophagus, stomach and duodenum. You will see from the plate that the esophagus empties to the liver side of the bulb. Whether this is a



Fig. 4—(Case 4)—Mrs. M. K.—Shows a full stomach which would hold its form for minutes. Nearly the entire stomach is above the diaphragm.

deformity of the stomach or whether it is due to a peculiar lifting up and tying of the stomach in this position, I am unable to say. There was no known history of injury.

Case 4—Mrs. M. K., 62 years old, was referred for gastro-intestinal examination, the complaint dating back many years. She believed the condition had become worse in the five years since a death had occurred in the family. She reported a feeling of fullness after eating, the pains being, however, confined to the chest, so that she felt as though the chest would burst. She reported that vomiting relieved all pain and that she regularly spat up food during the attacks. The first meal of the day seemed to cause the most pain. The patient was thin, was losing in weight and said she was suffering more often and more acutely than in former years. The pains were always in the chest, just back of the sternum. The color was fairly good. The symptoms

were very much those of an early partial obstruction of the esophagus.

In examining the patient under the fluoroscope the air bell was noticed above the diaphragm. Two glasses of barium mixture filled the stomach with the entire mixture above the diaphragm. Distress now became acute. Gaining the patient's confidence and assuring her that no harm would occur, it was noticed that some of the barium was showing below the diaphragm. The stream was small but steady. It was noticed that the stomach was following as the barium came down into the belly. The barium was not going into the duodenum, but the stomach was slowly coming through the diaphragm into its proper place, and after twenty minutes practically the entire stomach was in a normal position. By palpation the entire stomach, with the mixture, could be pushed back into the chest cavity. This was repeated a number of times on different days. The findings were constant. The patient was at high nervous tension and it was noticed that irritability on her part prevented the filled stomach from gaining its normal position. The stomach passed in and out of the thoracic cavity through an enlarged esophageal opening. The patient submitted to operation, and two years after the operation was comfortable.

These cases suffice to illustrate the extreme difficulty of diagnosis, even in traumatic cases. The diagnosis is much more uncertain when no known injury has been received.

#### SUMMARY

Diaphragmatic hernia, traumatic, is uncommon, but not rare.

Congenital diaphragmatic hernia is very infrequent.

The history is unusual.



Fig. 5—(Case 4)—Stomach emptying. Esophagus is seen full, due to regurgitation. Plate taken fifteen minutes after giving barium mixture.  
Fig. 6—(Case 4)—About twenty minutes after drinking the mixture. Stomach, except small portion, has regained normal position. Palpation could return the entire mass into the chest. Operation gave relief.

Digestive disturbance may be absent. Thoracic symptoms may fairly predominate.

Viscera may pass in and out of the thoracic cavity.

The patient may be fairly comfortable.

The clinical history is misleading.

The condition is not fatal unless strangulation occurs.

We cannot be absolutely certain of the existence of non-traumatic hernia. Injury might have been received without a known history.

The use of the x-ray will quickly make plain the condition.

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## Comparative Measurements of Intensity and Hardness of X-Rays Produced by Different Types of American Transformers\*

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Chicago

**F**IRST I want to express to you my gratitude for your kind invitation to read this paper before this famous society. During the last six months I have had the opportunity on trips from coast to coast to see and to measure different kinds of transformers under very different conditions. But these investigations have been performed only in order to answer the questions which the doctors asked me. For instance, how long would it take to cause a mild or a heavy erythema, or why under apparently normal conditions and a certain number of milliamperes-hours they did not get the expected skin reaction, or what the distribution of the rays would be in the depth of the human body, or how to produce an intensive and hard radiation in the most economical way, etc. In order to answer these questions I could not make systematic measurements of all electrical and radiological conditions of the various transformers; I could perform measurements only in a limited field of kilovoltage and milliamperage and filtration, such as radiologists require for practical purposes.

I can classify my measurements in the following manner:

(1) I investigated the intensity and hardness and the behavior of the tube under the conditions which the physicians used in treating their patients.

(2) I tried to improve the conditions and measured the same factors under these changed conditions.

(3) I observed intensity and hardness and tube action under the conditions which generally are used in America. I will call them normal conditions, namely:

200 kv.

5 ma.

1 mm. Cu + 1 mm. Al.

50 cm. F. S. D.

New x-ray tube.

The intensity under these normal conditions may be called the normal intensity produced by the transformer.

Concerning the possibility of these measurements I have to make some further explanations:

(1) For comparing intensity measurements we need an instrument which is sufficiently constant, so that reliable measurements can be made. The only method, which permits such measurements is the ionization method. By photographic means there is no possibility of measuring intensities and hardnesses with less error than 20 or 30 per cent. With the ionization method very exact measurements can be made. But with all iontoquantimeters difficulties originate from material leakage, lowering the exactness of the results considerably. I claim that an electroscope is the most accurate instrument. Of course, corrections must be made for the existing atmospheric conditions, either by calculation or by using a constant source of radiation, such as a 5 mg. radium needle. Both methods have been used by myself. Therefore I can compare intensities of different transformers with an error of less than 2 per cent. I would like to give the results of my measurements in electrostatic units, but there are differences between

the results of different authors. Therefore, I can give you the results relatively only.

(2) The hardness has been measured as a coefficient similar to the total absorption coefficient with a water filter of 2.3 cm. thickness. With heavy copper filtration this water filter measures the surface hardness, as well as the average hardness to a depth of 10 cm. with a comparatively small error. By comparison with different iontoquantimeters I can estimate the depth dose for 10 cm. depth and a certain port of entry, for instance, 20cm<sup>2</sup>. The error is very much higher than 2 per cent. as the voltage and amperage generally fluctuate during the absorption measurements. Since the quality of the rays is as important as the intensity, in order to determine the erythema time, I believe that this time can be given only with an error of about plus or minus five per cent.

(3) The sphere gap always has to be corrected for altitude, sometimes for unusual air pressures. I found many cases where this had not been done, so that the operators thought they were using 200 kv. when they had only 190 or 183. I see great difficulties in making very exact measurements with a sphere gap under different conditions and do not claim that my sphere gap readings are without error in all cases.

(4) All measurements of normal intensity should be performed with the same copper filter, as there are differences in the thickness and in the physical and chemical composition of different sheets of copper.

(5) The main difficulty arises from the tubes. I always had to use the treat-

\*—Read at the Annual Meeting of the Radiological Society of North America, Detroit, December 8, 1922.



ment tube. Sometimes two or three tubes were at my disposal. As a result of my investigation of tubes in Europe and America I have found that new tubes which are very highly evacuated produce the same intensity. If two or three new tubes are measured and they show the same intensity, then we can assume that the normal output of the transformer was measured correctly. If only one old tube is available we cannot make any definite statement about the transformer, as with another tube a better output might result. Several times I found old tubes which were 12 to 15 per cent below normal. In one case a tube, which had been in operation more than 1000 hours was 22 per cent below normal. In another case I attempted to measure a tube which was so soft that we could not keep the milliamperage constant. When measuring the intensity approximately I found it to be 30 per cent below normal. The hardness of the rays of different tubes varies very little if it is measured through one millimeter of copper, but that is due to the fact that all soft rays are suppressed by the heavy filtration, and only the hardest rays pass through. If the full amount of hard rays is not produced, either by a poor tube or by a wrong wave form, the measurements will show chiefly a small intensity and only a slightly less hardness of the rays.

(6) As to the behavior of the tubes I wanted to find out how the tubes would stand the various conditions. There are different possibilities:

(a) The tube becomes soft spontaneously or after running a short time.

(b) The tubes are punctured by sparks along or across the tubes.

(c) The tube becomes overheated, so that the target sags somewhat, or so that the glass of the tube cracks.

All transformers which I measured are compared with the Victor transformer, which Dr. Schmitz and I use in the Mercy Hospital at Chicago. In order to compare other transformers with this one I call the intensity which it produces under normal conditions one hundred. Thus the intensity of other transformers under normal or different conditions can be given as the percentage of this intensity. (The 100 per cent intensity amounts to .23 e/sec.).

The Victor transformer is very reliable. For one whole year of service we have not had any serious trouble. The tubes operated by this transformer and a full wave rectification stand 200 kv., not more, as the tube would be punctured by sparks. The milliamperage may be five, six or eight, without direct danger to the tube, but we found it advisable to use only 5 ma., as one tube cracked from overheating. Some tubes did not stand 200 kv. They be-

came soft after about 100 hours. Generally, as the Victor Company claims, 200 kv. is the practical limit if tubes are operated by this transformer and this rectifier.

Another Victor transformer showed exactly the same output.

A third Victor transformer showed an intensity of 85 per cent only with a new tube. In this case, trying two other tubes, the output was even 12 and 15 per cent below the first.

In all cases I measured such a hardness, that 42 per cent of the surface intensity would strike the depth of 10 cm. under the formerly named normal conditions.

The intensity produced by the fourth transformer was very low, 54 per cent, that is, 46 per cent below normal, under apparently the same conditions. With 720 ma. min. under normal conditions a very low erythema has been applied. In shifting the rectifier we were able to increase the intensity by only 15 per cent. Thus the filtration had to be lowered to  $\frac{3}{4}$  mm. copper, in order to shorten the time of treatment. The depth dose was 40 per cent.

The Kelley Koett transformer, until two months ago, was combined with a half-wave rectifier. With this output the tubes stand only 3.5 to 4 ma. With a higher milliamperage they turn soft. The output of this apparatus is also a little low. With the two transformers first installed I measured it to be 69 and 73 per cent. Four other installations showed values between 80 and 90 per cent. The last two installations show 94 and 95 per cent. The hardness of the produced radiation is nearly normal, 42 per cent depth dose, sometimes 0.5 per cent less.

In all cases where I measured these transformers I found that the tubes stand more than 200 kv. Thus, I increased the kilovoltage to 210 and 220. There was no case where the tubes did not stand it. Under these improved conditions the intensity measured 10 to 20 per cent higher, so that in many cases the 100 per cent output was reached. The hardness, under these conditions, improved also, so that 43 and 44 per cent reach the depth of 10 cm.

Within the last two months a new rectifying disc is combined with these transformers, which sends the full wave to each tube. The advantage of this new outfit is that the tube no longer becomes soft if more than 4 or 5 ma. are sent through it. The output is increased; in all three cases I found 100 per cent. With this double wave rectification the tubes are also very safe. They could be operated with more than 200 kv. If two resistances of one-half million ohms are inserted into the secondary circuit, protecting the tubes against

surges, the latter stands 220 kv. and more. With such a resistance the output drops about 2 per cent. But with 220 or 225 kv. the output is increased to 120 per cent, so that the time of treatment can be shortened considerably. In this case I measured a depth dose of 43 and 44 per cent.

The smaller 200 kv. Kelley-Koett transformer fitted with a full wave rectifying disc shows the same advantages, about 100 per cent output and protection of the tubes. They can work up to 215 kv. without sparks and then show an output and hardness much better than normal.

I standardized four Wappler transformers and found them all very easy on the tube, as they use large resistances in the secondary circuit and a full wave rectification. The tubes stand 5 to 6 ma. and more than 200 kv. I standardized some of these transformers with 220 kv. and did not see any fluctuation of the milliamperage. Regarding the normal intensity of these transformers I am not sure, as in one case I found 100 per cent intensity, in other cases I found it 6 and 29 per cent less than normal. In one case I found even less than that; but perhaps that was due to the tube, which was not perfect. In the best case with increased voltage the depth dose was 44 per cent and the output 120 per cent, that is, 20 per cent over normal.

The Standard transformer is quite extraordinary. It has a limited capacity, that is, if too high a milliamperage is taken the kilovoltage drops. I see three advantages of this property:

(1) There is no danger from touching the wires, because, if about 80 milliamperes are going through the body, the kilovoltage drops so low that it is no longer dangerous.

(2) It saves the tubes, as in a moment of gas development and of increased milliamperage through the tube the kilovoltage drops and lowers the gas development and the current.

(3) The surges are less dangerous, as with a higher kilovoltage the milliamperage is lower; with this transformer only, I found that heavy fluctuations in the secondary circuit, shown by inconsistent milliamperage readings have been harmless for the tube.

Of course, these transformers cannot produce the full intensity. I always found it 18 to 30 per cent lower than the Victor or the Kelley Koett. The depth dose was 41 or 42 per cent. The tubes being very safe with these transformers stand about 215 kv. Under these conditions the full output in many cases is reached. The depth dose is 43 per cent.

In one case I measured an International transformer and found the

normal output to be 107 per cent. In this case the biological observations showed that a mild erythema would be produced with 312 ma. min. under normal conditions; and with 200 ma. min. when 0.5 mm. Cu was used.

In two cases I have had the opportunity of standardizing a Rieber outfit. Rieber combined a small transformer with a full wave rectification and two step-up transformers, which double the tension of certain waves and suppress other waves, so that the double peak value is reached. I found the radiation produced by these outfits very low, 71 and about 60 per cent, certainly due to irregularities in the voltage curve. But this outfit has the advantage of protecting the tubes against high frequency surges and allows them to be operated with about 240 kv. without being punctured. Under these conditions the normal intensity is nearly reached; the depth dose is only 40 per cent, but with the increased kilovoltage it goes up to 43 per cent.

I may now draw the first conclusion: Different types of transformers and rectifications show differences in the output and behavior of the tubes. But there are great differences also between different machines of the same type. If those differences could be eliminated by the factories it would be a great advancement.

Finally I wish to compare the German Neo-Intensiv apparatus, measured in Augustana Hospital at Chicago, with the American transformers. In this special case the apparatus is equipped with half wave rectification. This transformer is very easy on the tube and this is due to the large resistances in the secondary. It is operated with 230 kv., but 3.5 ma. only, as the half wave rectification does not permit a higher milliamperage. The normal output is 96 per cent.

I wish to call attention to the following advantage of this machine: In the primary circuit a continuously variable resistance (a sliding wire) is inserted. This makes it possible to overcome the steps between two settings of the auto-control; that means that, not depending on primary fluctuations or the occasional value of the primary, we can choose each desired kilovoltage and keep it constant. This makes the practical application of the treatment more exact; but more especially it makes possible more exact measurements of intensity and hardness. I am glad to see doctors perform their own measurements of the constancy of the intensity or of the depth dose under different conditions, but generally difficulties and

errors arise, as the kilovoltage changes between readings. In some cases, especially if the sphere gap alone is used, without a primary voltmeter, it is practically impossible to make an exact standardization or other measurements, as nobody knows what the exact kilovoltage is during the time of measurement.

I claim that a primary voltmeter is necessary, that a continuously changeable resistance in the primary besides the normal auto or rheostat control is advisable.

I should like to make some further suggestions as to the improvement of installations in this country. Sometimes I found the rectifying needle or disc not properly installed. In many cases it is impossible to change it. I think it would be better to make it adjustable so that when necessary it may be easily adjusted.

Another recommendation concerns the installation of the tube. The newest development in this direction is the separation of the tube from the patient by a wall with a window, or by a table or a leaden box with a hole. That is very advisable and desirable, from a material and a psychological standpoint, especially as the patient is absolutely protected against the high tension current, noxious gases, noise and undesirable x-radiation. I saw beautiful installations made by the Kelley-Koett factory and Rieber, where the tube was under a table or behind a wall; I saw the large leaden boxes containing the tubes, such as the Wappler and International companies use. In all these installations right angles, horizontal or vertical beams are preferred. I think in many cases this installation covers all requirements; but in some cases we have to contend with various and difficult conditions and need different angles. For instance, if the supraclavicular glands and the neck are to be treated, we can scarcely do it with these types of installation.

Another physical suggestion may be permitted: Many physical investigations concerning the intensity and the hardness call for a horizontal central beam. For instance, if we want to measure the intensity or the total absorption factor of the radiation with the electroscope, we need such a horizontal beam. We also need it if we want to take the spectrum with a spectograph. It would be very interesting to measure the temperature of the anti-cathode by *optical methods* under different conditions, and with different transformers. All this could be done better with a horizontal beam. I am

sure that in the future more physical measurements will be performed than now; and the more numerous the conditions and the possibilities of producing x-rays become the more we need such physical investigations.

In three cases I measured 200 kv. transformers in the altitude of about 5000 and 6000 feet. Under these conditions the tubes can only be operated with 175, 170 or 165 kv. Of course, the intensity was very low, about 70 and 60 and 40 per cent. Therefore, a greater milliamperage had to be used, and a lower filtration of only  $\frac{3}{4}$  mm. Cu was advisable in order to treat a patient. The hardness under these conditions equals 39 per cent depth dose. The best and most economical way to produce 200 or 210 kv. in this altitude would be to use a 200 kv. transformer, combined with a 240 or a 280 kv. disc. Both terminals of the transformer have to be insulated by a large sheet of mica in order to prevent sparking between them.

If we consider all these facts we come to the conclusion that under the different conditions of producing x-rays and with the very different output of rays the possibilities of determining the used energy by a statement of the number of the milliamperes minutes no longer exists for the comparison of transformers. I found physicians applying a low erythema with a weak transformer and a great number of milliamperes minutes, under the impression that they were applying a heavy dose. If radiologists wish to compare the transformers or the doses then they need standardizing measurements made by a physicist or they should make their own measurements with standardized instruments. There are three instruments on the market:

(1) The German iontoquantimeter, standardized by Friedrich in a certain physical unit, which makes it possible to apply an exactly determined erythema dose.

(2) The ionizing chamber of Professor Duane, standardized in "e" units.

(3) My standardized electroscope may also be made use of by physicians for the purpose of standardizing and keeping a check on the output of their machines.

I am now trying to establish the electrostatic units by eliminating the differences which now exist between the measurements of Friedrich, Duane and myself. I hope after a short while we will have a standard physical unit which will enable one to compare intensities and energies independently of individual methods of measuring.

# EDITORIAL

## The JOURNAL OF RADIOLOGY

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### Scientific Advance and Research

BLACKBIRD HILL overlooks the Missouri River. From its top one can see for miles down the river up which the first white man came. The hill bears this name in honor of the Chief of the Dakota Indians, whose body rests there upon the back of the powerful black stallion which carried him through many battles. Chief Blackbird was buried on this mount at the highest point on Blackbird Hill in accord with his dying request, so that he might be there, ready to see the first white man come up the Missouri River. Sure enough, four years later, Lewis and Clarke came up the river, sighted Blackbird Hill and found on its summit the burial mound of Chief Blackbird.

#### CHIEF BLACKBIRD

From the Dakota Indians, over whom the chief had ruled, they obtained some of the salient facts about his life. He stood more than six feet in height, was broad of chest, erect and keen of eye. He loved peace, but ruled his people with a firm hand, every subject revering him as one who held the power of life and death in his hand. When Chief Blackbird fell asleep there was always some faithful Indian present to gently stroke the muscles of his tired legs and arms so that when he awoke he would feel physically powerful. When they awakened him they were always careful in arousing him, lest he be angered and they fall from his grace. Chief Blackbird always rode the finest horse owned by the tribe, sometimes on peaceful journeys, sometimes in warfare. Since he was by nature a lover of peace he waged war only when attacked, but when he fought he showed no quarter and was never defeated.

At last smallpox entered the camp of the Dakotas and large numbers of them died. Finally Chief Blackbird himself became sick with the disease, quickly weakened, died, and was buried on the crest of Blackbird Hill, as had been his request.

#### ABRAHAM LINCOLN

This hill has become a landmark because of its significance in the history of Nebraska in the latter part of the eighteenth century. A few miles down the Missouri River, within the domain formerly ruled by Chief Blackbird, another hill has become of great historical interest. On the crest of this hill stands a granite monument marking the spot where President Abraham Lincoln stood when he visited the Missouri Valley to locate the eastern terminus of the Union Pacific Railroad. Only sixty-seven years had passed between the death of Chief Blackbird and the visit of President Lincoln. The significance of that visit will not be fully

realized by this generation. All that rail transportation means to the development of the great continent of North America is wrapped up in that hill hallowed by Abraham Lincoln's footprints.

When Chief Blackbird lived, transportation was carried on by means of packs on the back of the human footman. A little later the "prairie schooner" was drawn across the plains by oxen. Now every morning and every evening the aeroplane brings the mail to a landing field not far from where President Lincoln stood in 1867.

When Chief Blackbird lived the tepees were lighted by the flickering flame of the burning log. When the boy Lincoln was educating himself it was by the flickering light of the open fireplace. Now electric lights turn night into day, making study and travel at night as easy as when the sun is shining.

When Chief Blackbird lived, messages were carried by pages on foot; now a powerful wireless station, situated within the shadow of the monument erected in memory of President Lincoln's trip to Council Bluffs, sends messages to all parts of the North American continent.

The changes mentioned above have taken place in about one hundred and fifty years. It requires a vivid imagination to picture this kaleidoscopic image. Professor James Harvey Robinson, in his book, "The Mind in the Making," has expressed the same thought in the following words: (The italics are the author's own).

"We have, however, first to create an *unprecedented attitude of mind to cope with unprecedented conditions and to utilize unprecedented knowledge.* \* \* \*

How are we to put ourselves in a position to come to think of things that we not only never thought of before, but are most reluctant to question? In short, how are we to rid ourselves of our fond prejudices and *open our minds?* \* \* \* When we compare the discussions in the United States Senate in regard to the League of Nations with the consideration of a broken down car in a roadside garage, the contrast is shocking. The rural mechanic thinks scientifically; his only aim is to avail himself of his knowledge of the nature and workings of the car, with a view to making it run once more. The Senator, on the other hand, appears too often to have little idea of the nature and workings of nations, and he relies on rhetoric and appeals to vague fears and hopes or mere partisan animosity. The scientists have been busy for a century in revolutionizing the *practical* relation of nations. The ocean is no longer a barrier, as it was in Washington's day, but to all intents and purposes a smooth avenue closely connecting, rather than safely separating, the eastern and western continents. The Senator will nevertheless unblushingly appeal to policies of a century back, suitable, mayhap, in their day, but now become a warning rather than a guide. The garage man, on the contrary, takes his mechanism as he finds it and does not allow any mystic respect for the earlier forms of the gas engine to interfere with the needed adjustments."

It would appear that Professor Robinson has clearly outlined the tendency of the times toward scientific thinking. At the same time that this change in the thought of the general mind is taking place, a similar advance in the thought of the medical profession is taking place. With this change in



the profession itself has come an added respect of the public for the practice of medicine. Not further back than the seventeenth century the medical profession and its practices were held up to ridicule, as evidenced by Moliere's *La Malade Imaginaire*. This drama, written by a dying man in his last illness, is his most powerful thrust at the foolish practices which he felt only hastened his end.

It is a considerable change from this picture to that recently painted by the actions of Governor Smith of New York, who called distinguished representatives of the medical profession to help formulate plans for needed legislation in matters pertaining to the public health, a consultation which should result in New York state having a sane and sound policy in public health legislation.

#### FREDERICK GRANT BANTING

Recently, in our community, a young matron, beautiful in mind, in spirit and in body, the mother of small children, was stricken with diabetic coma and within a few hours was dead. She had not known that she was afflicted with diabetes. In the future such an untimely end to so beautiful and useful a life will be unnecessary because of the self-sacrificing, scientific effort of Dr. Frederick Grant Banting, who has shown us the way to secure insulin. This man, working as an assistant in physiology at Western University, London, Ontario, conceived the idea which carried on through toil and sacrifice resulted in the isolation of the life-saving product insulin. The research worker must be an idealist with his wagon hitched to the star which leads him on to success, but he must at the same time have cooperation from men in allied lines of endeavor upon whom he may be free to call for assistance. This happy combination was afforded at the University of Toronto under the leadership of Professor J. J. R. Macleod. Here the resources of the physiological laboratory, the department of pathological chemistry and the department of medicine all cooperated in bringing this valuable contribution to science to a successful end. Who can picture the numberless lives which will be saved to future generations by this painstaking effort on the part of Dr. Banting?

Not only in this particular instance, but in many others, the same spirit is manifest.

#### WALTER EDWARD DANDY

Another illustration of the value of cooperation in medical research is that the ventriculography in the diagnosis and localization of brain tumors. One day Dr. W. E. Dandy saw an x-ray plate of the abdomen of a patient suffering from typhoid perforation and noticed that the gas which had escaped into the peritoneal cavity made the diaphragm much more plainly visible. This observation suggested to him the injection of air into the ventricles of the brain as an aid in localizing brain tumors. So valuable an aid has this method become that Dr. Dandy recently made the statement that he considered ventriculography the most valuable aid to brain surgery. His work has now made it possible to definitely localize a tumor in any portion of the brain, thus saving the lives of patients who were formerly doomed to certain death.

#### WILLIAM CONRAD ROENTGEN

In the field of radiology we have the illustrious example of the late Dr. Roentgen, whose recognition of x-rays has not only revolutionized medicine, but has completely changed chemistry and has contributed greatly to the advancement of other branches of science.

#### WILLIAM DAVID COOLIDGE

Floyd W. Parsons in the Saturday Evening Post, May 5th, in an article entitled "Pioneering Beyond the Rim," calls attention to the value of scientific research, and cites the contribution of Dr. W. D. Coolidge to scientific advance. Through the work of Dr. Coolidge a process for making

ductile tungsten wire was found. This greatly widened the possibilities of illumination, and in turn made the Coolidge tube possible. The self-rectifying x-ray unit and present day deep therapy would have been impossible without the work of Dr. Coolidge.

Mention was recently made in these columns of the sacrifices which led to the prevention of yellow fever and typhoid fever, and the history of medicine is replete with illustrations of the most self-sacrificing devotion to research which has resulted in great common good, but only too often these sacrifices are apt to be forgotten in our enjoyment of the life given to us by them.

It is very gratifying that such men as Mr. Parsons, and such powerful publications as the Saturday Evening Post, should take up constructively a program looking to co-operative effort in scientific research, because with such forces at work success is eventually certain, as indeed it should be certain, the future of the nation and humanity considered.

No disagreement exists concerning either the value or the method first espoused by the Journal and now so completely sanctioned by Mr. Parsons, as will quickly be seen by reading the latest of his series on the relation of science to everyday life. There is probably room for serious discussion, however, concerning his suggestion that this co-operative effort should be conducted in a large laboratory exclusively under the control and direction of industry. This, presumably, because it is believed that such a plan will keep research closer to practical application to industry and give business supervision and immediate financial support to the undertaking.

Speaking broadly, no one will dispute Mr. Parson's statement that the educational institutions of the country are more or less out of touch with the needs of industry. But that is all the more reason for using all the laboratories and personnel maintained at public expense in such a way as will do much to cure the present deficiency in our educational system, and at the same time give to the younger generations contact with science in industry. Certainly such a method ought to combine effectively scientific methods with theoretical teaching in a practical manner which would unquestionably prove of enormous value to the individual, to industry, to the nation, and to the world at large.

While it must be conceded that scientific research is purely the product of individual ingenuity and perseverance, yet it has been so clearly demonstrated that helpful co-operation is productive of greater scientific achievement, that in the first instance mere quibbling over details should not be permitted to stand in the way of accomplishing such an important development in our scientific life.

#### Iowa State Radiological and Physiotherapy Society

AN ALL DAY meeting of one hundred and twenty-two doctors interested in radiology and physiotherapy was held at Ottumwa, Iowa, May 8th, 1923, which resulted in the formation of the Iowa State Radiological and Physiotherapy Society with the following officers elected:

President . . . . . W. A. JOHNSON, M. D., Dubuque, Ia.  
Vice-President . . . A. L. YOCUM, JR., M. D., Chariton, Ia.  
Secretary-Treasurer . . B. H. SHERMAN, M. D., Dexter, Ia.

#### Miles Bronson Titterington, M. D.

July 13, 1870 :: :: :: March 25, 1923

Once more the dread harvester has appeared, and with his practiced hand, hewed away a life precious to the x-ray world. It is to chronicle the passing of the second president of the Radiological Society, and a charter member, that the writer (who, perhaps, was closer to Dr. Titterington, than

# EDITORIAL

any other radiologist), endeavors to make empty words pay the tribute of the heart. An ancient sage said "Language was made to conceal thought," and it not infrequently seems that this statement is true. All the words of grandeur, of beauty, of high sounding timbre, coupled as only a lexicographer could couple them, would mean but little to the stilled heart of Dr. Titterington. It is to be regretted that someone, somewhere, sometime, during Dr. Titterington's lifetime, could not have said some of these deserved complimentary things to him whilst his heart could feel and his brain could understand; this eulogy to his memory cannot delight any person whomsoever; to his family it recalls his virtues; to his friends it brings home their lack of outspoken appreciation during the brief hours upon earth, when it was possible to say "You are a good fellow."



Dr. Titterington has sat at the banquet table and has taken a silent part in the award of gold medals to his brother x-ray workers; he has helped to bestow honorary memberships upon the worthy; yet he went through life without so much as a scratch of a pen, or bauble of whatsoever nature that might be laid up as a memorial in the archives of his family, to remind them that he had presided over the destinies of the Radiological Society as its second president.

The writer well remembers the only comment made by Dr. Titterington upon the successful fruition of the efforts of founding a new x-ray society. Several years had elapsed; war had come and had gone; and one day in a quiet hour, and over a restful cigar, Dr. Titterington remarked, after

the business of the society had been discussed, "Well, old war-horse, we started something, didn't we?" That was the first and last comment upon the past, present and future of the wonderfully successful organization.

Generous to a fault, his hand was first to "dig" when a worthy project was proposed. When the Journal of the Society was suffering from the effects, as did everything, of war inflation, he was among the first to open his private purse that the Journal might live and "carry on."

Dr. Titterington wrote many articles of a practical nature which were presented at various roentgen ray society meetings, and published in the various journals, but he never took sufficient time to prepare in book form anything appertaining to the roentgen ray. His work was ever to the simplification of technique and toward the practical application of theory. Where many a less modest master, with such a large and varied experience extending over two decades, might have blossomed forth in book form, Dr. Titterington was content to impart his knowledge in terse, sledge hammer "punches" that took little of printers ink, but bore weighty messages.

It was unusual to see him out of temper. Ever ready and willing to suborn his own pleasures to the will of the majority he found his satisfaction in enjoying the delights of others. His laboratory was ever open to all seekers after knowledge; he never saw a "stranger," in fact, no one could long be "strange" to the beaming eyes and winning smile of the grand old warrior who has gone to his reward. Providence was kind in leaving him a son, Paul F. Titterington, a physician and roentgenologist, who will carry on his work.

Miles Bronson Titterington was born in Rock Island County, Illinois, July 13, 1870. He graduated from the College of Physicians and Surgeons in St. Louis, Mo., and entered the practice of medicine in 1894. He wedded Miss Clara Webster of Alton, Illinois, on February 5, 1894, and to the union was born a son, Paul F., January 17, 1895.

Like most of the "old" x-ray workers, his first medical work was in general practice, gradually giving way to the roentgen ray as this latter grew into prominence. He held many hospital appointments in St. Louis, but resigned them the better to care for his extensive private laboratory work.

In February, 1921, whilst awaiting a "late" patient in his office, Dr. Titterington suffered a cerebral hemorrhage that put him into the hospital for a month. His recovery was marvellous, but to the practiced eyes of his old friends the "old" vim and vigor were missing. March 2, 1923, seized with an attack of appendicitis, and having to drive sixty miles through mud, where it was often necessary to dig out the auto, the old Spartan did his share of the labor, only to arrive in St. Louis with a ruptured appendix, which when operated gave way to insufficient kidney function, and that to a pleural effusion, which at the end of three weeks closed his eyes in final slumber after as courageous a battle as has even been fought from a sick bed.

Floral designs in plenty from sorrowing friends everywhere gave mute testimony to the esteem in which he had been held. Radiologists from many cities attended the funeral. In compliance with his wishes he was cremated, Tuesday, March 27, 1923, and thus passed into the wonderful adventure, Miles Bronson Titterington.

He was prominently identified with the Elks, Masonic Order and Shrine, the St. Louis City Roentgen Club, the American Roentgen Ray Society, and was a past president of the Radiological Society of North America. The radiologic world is the better for his having lived and toiled within the fold.

May his soul rest in peace.

F. S. O'HARA, M. D.

Program Mid-Annual Meeting

J. T. STEVENS, M. D., *Montclair, N. J.*—"The Treatment of Malignant Diseases of the Cervix and Uterus with New Higher Voltage Shorter Wave Length Roentgen Rays, Radium and Electrothermic Coagulation."

Discussion opened by HENRY SCHMITZ, M. D., *Chicago, Ill.*; H. H. BOWING, M. D., *Rochester, Minn.*

H. J. ULLMAN, M. D., *Santa Barbara, Calif.*—"X-ray Dosage: Standardization Versus Individual Adaptation."

Discussion opened by HENRY SCHMITZ, M. D., *Chicago, Ill.*; EDW. C. ERNST, M. D., *St. Louis, Mo.*

W. H. WALLACE, M. D., *Brooklyn, N. Y.*—"Delusions Illusions and Facts in Radiographic Examination of the Gastro-Intestinal Tract."

Discussion opened by W. W. DUKE, M. D., *Kansas City, Mo.*

ALBERT SOILAND, M. D., *Los Angeles, Calif.*—"Further Remarks on Protective Measures with Special Reference to High Voltages."

Discussion opened by J. T. STEVENS, M. D., *Montclair, N. J.*; B. H. ORNDOFF, M. D., *Chicago, Ill.*

AMEDEE GRANGER, M. D., *New Orleans, La.*—"Further Observations with the Author's Sphenoid Line and Position for Making Radiographs of the Paranasal Sinuses."

Discussion opened by FREDERICK H. RODENBAUGH, M. D., *San Francisco, Calif.*; W. W. WASSON, M. D., *Denver, Colo.*

IRVING S. INGBER, M. D., *San Francisco, Cal.*—"Papillomatous Growths of the Stomach; A Roentgenological Study."

Discussion opened by LLOYD BRYAN, M. D., *San Francisco, Calif.*

L. K. POYNTZ, M. D., *Portland, Ore.*—"The Treatment of Carcinoma of the Breast by the Roentgen Ray."

ROLLIN H. STEVENS, M. D., and HANS JARRE, M. D., *Detroit, Mich.*—"Treatment of Cancer of the Breast by Deep Radiation and Surgery—A Rational Method According to Present-day Knowledge."

Discussion opened by ALBERT SOILAND, M. D., *Los Angeles, Calif.*; EDW. C. ERNST, M. D., *St. Louis, Mo.*

HARRY SPIRO, M. D., *San Francisco, Calif.*—"Determination of the Quality of the Heart Muscle by Fluoroscopy."

W. W. WASSON, M. D., *Denver, Colo.*—"Sarcoma of the Bone with Report of Cases."

Discussion opened by M. J. HUBENY, M. D., *Chicago, Ill.*; W. E. CHAMBERLAIN, M. D., *San Francisco, Calif.*

MAXIMILIAN J. HUBENY, M. D., *Chicago, Ill.*—"Localization of Foreign Bodies in the Eye."

C. B. WARD, M. D., *Spokane, Wash.*—"Comments on

German Methods of Deep Roentgen Therapy for Non-Malignant Lesions."

W. W. DUKE, M. D., *Kansas City, Mo.*—"Treatment of Splenomyelogenous Leukemia by Irradiation of the Chest; a Preliminary Report."

H. H. BOWING, M. D., *Rochester, Minn.*—"Preoperative Radium Application in Early Carcinoma of the Cervix Uteri, with Case Reports."

Discussion opened by C. B. WARD, M. D., *Spokane, Wash.*

HENRY SCHMITZ, M. D., *Chicago, Ill.*—"Treatment of Latent X-ray Burns."

Discussion opened by A. W. ERSKINE, M. D., *Cedar Rapids, Iowa.*

L. T. LEWALD, M. D., *New York City.*—"Syphilis of the Stomach, Appearances Before and After Treatment."

Discussion opened by W. W. DUKE, M. D., *Kansas City, Mo.*

ALEXANDER H. PEACOCK, M. D., and J. T. DAWSON, M. D., *Seattle, Wash.*—"X-ray as a Vital Aid in Urological Surgery."

Discussion opened by W. B. BOWMAN, M. D., *Los Angeles, Calif.*; LEON T. LEWALD, M. D., *New York City.*

M. J. BURNHAM, M. D., and JNO. R. O'NEIL, M. D., *San Francisco, Calif.*—"Chorioma Discussion of Pathology of Lesion, Its Metastasis and Treatment."

Discussion opened by B. H. ORNDOFF, M. D., *Chicago, Ill.*

A. W. ERSKINE, M. D., *Cedar Rapids, Iowa.*—"A Further Study of Dessauer Charts."

Discussion opened by H. J. ULLMAN, M. D., *Santa Barbara, Calif.*

B. H. ORNDOFF, M. D., *Chicago, Ill.*—"Investigation of the Appendix in Connection with Lesions of the Gastro-Intestinal Tract."

B. C. CUSHWAY, M. D., and R. J. MAIER, M. D., *Chicago, Ill.*—"The Symptomatology and Radiological Findings in Chronic Appendicitis."

Discussion of papers by DRS. ORNDOFF, CUSHWAY and MAIER opened by O. H. MCCANDLESS, M. D., *Kansas City, Mo.*

PHILIP K. BROWN, M. D., *San Francisco, Calif.*—"Roentgenologic Differential Diagnosis of Cavities and Small Pneumothoraces."

Discussion opened by KENNON H. DUNHAM, M. D., *Cincinnati, Ohio*; W. W. WASSON, M. D., *Denver, Colo.*

D. L. WEBSTER, Ph. D., *Department of Physics, Leland Stanford Univ.*—"The Distribution of Energy in the Continuous X-Ray Spectrum."

ROBERT J. MAY, M. D., *Cleveland, Ohio.*—Title to be announced.

I. S. TROSTLER, M. D., *Chicago, Ill.*—"An Important Malpractice Case Decision."



## DEPARTMENT of TECHNIQUE

### Three Suggestions on Protection of Deep Therapy Tubes

E. B. KNERR, M. D.

Kansas City, Mo.

IN OPERATING deep therapy apparatus any means tending to protect the tubes will doubtless appeal to the operator. With this thought in mind the writer offers the following suggestions:

(1) Placing of filters: In distributing the sheets of copper and aluminum filters beneath the tube first insert plate of photographic glass nearest the tube, then the copper sheet followed by a sheet of aluminum, and then such remaining filters as may be desired. A discarded glass negative may be cut to the desired size and serve as the glass plate. The filtering effect of photographic glass is about the same as an equal thickness of aluminum. The purpose of the glass plate placed between the tube and the metal filters is to insulate the tube from shortage and static by way of the metallic filters. The writer has known of two tubes being punctured because the aluminum filter had been placed too near the tube.

(2) To prevent overheating of the tube a blower is furnished with some types of apparatus. The writer has on some occasions observed this blower directing its blast across the top of the tube at great risk to the latter, because of the very uneven temperature produced in its walls. The blower should

have its blast directed downward between the tube and lead-glass bowl on one side causing it to circulate about the tube and make its exit upward on the other side, thus insuring uniform cooling of the tube.

(3) The brilliancy of the target in operation is an index of its temperature and of the behavior of the tube. Any marked increase or decrease of the brightness of the anode under operation is a sure sign of trouble. A careful operator likes to have a clear view of the target and takes a frequent glance through the lead glass window at the anode and the reflection of the focal spot from the walls of the tube. But the anode under a 200 kv. stress at four or five milliamperes is too brilliant to look at directly with comfort and its glare is too confusing to permit its observation to be of any practical value.

This glare may be readily eliminated by viewing the anode and its tube reflections through a graduated photographic film attached to the lead glass window, and in the line of vision as the observer looks toward the tube. A convenient film may be prepared as follows: An eight by ten inch film, or larger if desired, is placed in a paper container and on this a succession of layers of aluminum or glass is so arranged that each heap is one layer of aluminum (or

glass) thicker than the preceding one. The several heaps should be disposed about two inches apart, like a series of shallow steps. In other words, rule the paper container holding the sensitive film with a series of lines two inches apart across the face dividing it into five fields. Over the field at one end of the plate place nothing. Over the second field and the remainder of the plate place a sheet of aluminum or glass about a millimeter thick. Over the third field and the remainder of the plate place another sheet of same thickness, and so on for the remaining fields. Now expose the plate for one second at about a three-inch gap and 25 ma. Develop full time. When fixed, washed and dried, this film of graded densities, hung with its several fields horizontal, is to be fastened to the lead glass window in the operator's line of vision as he observes his tube. By a slight movement of the head the observer can readily view the glowing anode in any field of density of the graded film that he may desire, and judge of its temperature by the amount of light transmitted. He may also find a reflected image of the focal spot and judge somewhat of the punishment he is giving his tube by the density of the field necessary to absorb its half-light say, or to blot it out entirely.

## ABSTRACTS and REVIEWS

Preparing a Paper for Publication.  
Editorial in Texas State J. Med.,  
18:541, March, 1923.

THIS, says the author, is no small task, or if it is there is most likely to be a seriously deficient manuscript. The writer states that he is not urging that medical men produce literary gems, but that they "write intelligently and in such English as will produce a minimum of embarrassment in educated company."

The trouble, says the author, is that medical men are busy men. They throw

their papers together for reading, expecting to polish them a little in the reading and later to rewrite the paper, which seldom is done. Then comes the galley proof "with a more or less polite note from the editor and the incident is closed. He does not realize the grief he has caused the long suffering editor, who has to study his manuscript carefully, determine what it was he wanted to say, and then see that he says it, as nearly as possible in his own language and at the same time in reasonably good English. Considering the

limited capabilities of the editor, that is no small task."

The writer goes on to quote from an article by Dr. Zinke of Cincinnati, who says in a recent publication: "To write a good paper you must first select the subject \* \* \* the next step is to examine the literature \* \* \* then to compare the experiences and studies of others with your own. This done, make your dispositions and write out in detail what you have to say \* \* \* lastly, draw your conclusions.

"After the manuscript is completed put it aside for a week or two, but continue to think of the subject, making a note now and then as to what you would like to add or omit. At the end of this period read the manuscript a second time and you will be surprised to find the many changes, additions, omissions, and transpositions you will find it necessary to make. You may even marvel how it was possible for you to write as poorly as you did.

"Again the paper in its improved form is locked away for another reading at the end of a week or two; and when you read it for the third time, you will find words, phrases, and even sentences that may be changed to advantage to make the subject matter clearer, the organization more compact, the diction more forceful and pointed.

"The next and final rereading should be devoted to polishing the paper. Remove every superfluous word, phrase and sentence. See that your adjectives are properly selected, and correctly shaded, and that your language is pure, simple, effective, and inoffensive to those who may disagree with you.

"After you have thus labored to do your best with the manuscript, submit it for careful perusal to one who is a master (or nearly so) of the English language and ask him or her to point out further defects and shortcomings, especially with reference to the syntax, punctuation, paragraphing and diction."

"Fine!" sighs the Texas editor, and adds, "Let us give more heed to such matters. Some day we are going to have time enough to treat our editorials that way \* \* \* when our contributors have done so. It requires little time to edit a carefully prepared manuscript."—And more time than one might think to edit a poorly written one.

The Scope of the Roentgenologist's Report. Charles D. Enfield, M.D., J.A.M.A., 80:999-1000, April 7, 1923.

THERE are two extremes found in roentgenologic reports, and as a rule both are equally bad and useless to the man receiving them. In one a bald recital of details is given, a word picture, very useful to another roentgenologist, but having no meaning to the clinician who is not a roentgenologist. The other extreme form presents the x-ray diagnosis, perhaps in one sentence; it gives the roentgenologist's opinion, but not his reason for that opinion, which is far from satisfactory. Aside from this the roentgen ray seldom can establish a diagnosis by itself, and so this form of report is, if anything, worse than the other one.

Another type of report simply states that no evidence of disease was found

and makes no report of findings that might possibly have a bearing on the case, at times there may be indications of some unsuspected pathology which will be entirely missed unless report of them is given the clinician.

The author summarizes his paper thus: "It would seem that the ideal roentgen ray report should present a careful and accurate description of the picture seen. It should offer whatever explanation of variations from the normal may be conservatively given on a basis of established roentgen pathology. It should give, when this can be conservatively done, an estimate of the activity and present importance of the lesions; such estimate, however, to be derived entirely from the roentgen signs. It should place in the hands of the clinician all the information the roentgenologist has been able to obtain by his peculiar method of examination, and should offer it in such form as will most facilitate the correlation of the roentgen and clinical evidence."

A Complete Examination of the Chest. James A. Honeij, M.D., Am. J. Roentgenol., 10:247, March, 1923.

DR. HONEIJ says that the simplest cases are frequently the most difficult of interpretation and that to his sense of touch and hearing the clinician should add the sense of sight, which he may do by using the fluoroscopic and radiographic methods now at his disposal.

New Growths Within the Chest: X-ray Diagnosis. Samuel B. Childs, M.D., Am. J. Roentgenol., 10:175-182, March, 1923.

THE CHANGES characteristic of new growths and also those associated with certain inflammatory conditions are first reviewed, the growths of the chest being classified under those of the mediastinum and of the lungs. Hodgkin's disease, lymphosarcoma, intrathoracic thyroid, enlarged thymus, cysts, cold abscess, aneurism, tuberculous glands and the primary and metastatic malignancies are discussed together with the differentiation of benign and malignant growths.

The author's summary reads as follows: "The x-ray furnishes valuable evidence in all new growths within the chest, and in some of these conditions a positive diagnosis can be made from its use alone. It is considered, however, that in all cases of new growths, the x-ray should be combined with the clinical and laboratory evidence before a positive diagnosis is made. Primary carcinoma of the lung presents, generally, a fairly definite group of symptoms as well as a rather typical x-ray picture, and, although it is not com-

mon, yet it occurs sufficiently often for the clinician and the roentgenologist to bear the possibility of its existence in mind, when the findings in a given case are not satisfactorily accounted for by the diseases ordinarily found in the lungs. When the combined evidence is before us, mistakes in this diagnosis will be greatly lessened."

New Growths Within the Chest. J. N. Hall, M.D., Am. J. Roentgenol., 10:182-187, March, 1923.

DIAGNOSIS of malignant diseases within the chest the author believes to be possible in the majority of cases where it exists. These malignant diseases may involve the lungs, bronchi, pleurae, mediastinal glands, thymus, thyroid and the esophagus. Teratoma is included also.

Increase of malignant disease of the lungs and bronchi has occurred lately and the author ventures the opinion that the influenza epidemic has had its part in this, and he says, "Doubtless, a chronic inflammatory lesion always precedes the malignant growth."

The etiology, localization, symptoms, physical signs, clinical and laboratory diagnosis, and complications of new growths of the lungs and bronchi occupies most of the article. Malignancies of the pleurae and mediastinum and differentiation of these latter from tuberculosis are discussed throughout one page.

"In conclusion we should state that metastasis of malignant tumors to the chest is so common that roentgenological examination of the thorax before operation of such cases is as necessary as the customary palpation of the liver for metastatic nodules. We have said little of treatment. Unless the growth can be checked in some degree by the use of the x-ray, we can offer but little hope."

Pleural Effusions. Willis H. Watson, M.D., Northwest Med., 22:119-122, April, 1923.

WHEN a patient complains that breathing is embarrassed when lying on one side or the other and the respirations are accelerated, one should suspect fluid within the chest. Radiographic examination of the chest should be a routine procedure before all operations and in the presence of any post-operative complications should be repeated. \* \* \*

"Fluoroscopic examination in the upright position is the one of choice, as it reveals the fluid level, and when the position of the body is inclined to the right or left the same fluid level is observed. Fluoroscopic or radiographic findings made in the prone position are misleading, and the shadow produced by a small amount of the fluid is so dif-

fuse that it may be overlooked, whereas a large amount of fluid obscures other pathology in the chest.

"However, it is of some aid when comparing it with the findings of the radiograph made in the upright position. Obliteration of portions of the pleural sac with walled off areas of fluid give rise to a different picture."

Non-Tuberculous Pulmonary Abscess. Wyman Whittemore, M.D., Bost. M.&S.J., 188:497, April, 1923.

DR. WHITTEMORE has this to say of x-ray examination in these cases: "The x-ray may be said to be the most important examination, for in many instances it makes the diagnosis, and in all cases it localizes the process more accurately than any other examination, this localization being of the greatest value to the surgeon in contemplating operation."

The Effect of Small Doses of Roentgen Rays in Certain Forms of Impaired Hearing. D. C. Jarvis, M. D., Am. J. Roentgenol., 10:201-202, March, 1923.

FROM CERTAIN striking experiences in his practice the author has been led to the following conclusions: "Small doses of roentgen rays are a valuable aid in treating aural disease. They are most valuable in cases disclosing a prominent throat element. It would seem that results are obtained by the roentgen rays influencing the bacterial content of the throat. Their influence is most marked on tinnitus aurium, relief following soon after the treatment."

Witherbee's tonsil technique was used in giving treatment to those patients reported in this paper.

Treatment of Defective Hearing by Small Doses of X-rays. John McCoy, M. D., Am. J. Roentgenol., 10:203, March, 1923.

THE TYPES of cases and the conditions causing defective hearing were as follows:

"Otitis Media Catarrhalis Chronica (O.M.C.C.) otherwise known as chronic dry catarrh. Otitis Media Purulenta Chronica (O.M.P.C.) Otitis Media Purulenta Residua (O.M.P.R.), and Otosclerosis."

O.M.C.C.	{ Greatly improved . . .	9
	{ Slightly improved . . .	19
	{ Not improved . . . . .	7
O.M.P.C.	{ Greatly improved . . .	0
	{ Slightly improved . . .	2
	{ Not improved . . . . .	0
O.M.P.R.	{ Greatly improved . . .	1
	{ Slightly improved . . .	1
	{ Not improved . . . . .	0

Otosclerosis	{ Greatly improved . . .	2
	{ Slightly improved . . .	2
	{ Not improved . . . . .	2

The method and technique is as follows: "The patient is seated 30 inches from the target and has the x-rays applied in turn to the right ear, left ear, the occiput, and the open mouth, in a direction toward the pituitary gland. A 110 volt current is used with a four inch spark gap and from five to ten ma. The exposure lasts from ten to thirty seconds laterally, from ten to twenty seconds posteriorly and from five to fifteen seconds anteriorly. An opaque shield with a perforation three inches in diameter is used laterally. The shield is held in front of the eyes for the anterior exposure. The treatments are given two or three times weekly for three to six weeks."

In conclusion the author states that the treatment is not harmful and is often beneficial, therefore is worth a trial.

Correct Radiographic Technique and Interpretation in Its Relation to the Elimination of Oral Pathologic Foci. Frederick F. Molt, D.D.S., Dental Cosmos, 65:341-346, April, 1923.

THIS WRITER urges medical assistance of the highest order in the realm of dentistry. Simpson's characterization of many x-ray laboratories is given—"radiographic shooting galleries—so much a shot, hit or miss," and his characterization of the sort of interpreter too often found in these laboratories—"a histopathologic clairvoyant." Between the faddist and the ultraconservative (too frequently the latter is merely selfishly reluctant to accept professional advances) there is much room for the exercise of sane radiography.

A standardized technique is greatly needed. The most desirable radiographic film is one made with little penetration, three to three and one-half inches back-up being enough in most cases, two inches in edentulous mouths. The McCormack technique making exposures at a target distance of from 24 inches in the anterior to 36 or 40 inches in the posterior, the light thrown by the Coolidge filament being utilized for focusing, is a particularly desirable technique to use with upper molar exposures "inasmuch as through it the relation of root apices to antrum floor is shown and the malar shadow thrown out of practically all radiograms. Using 20 ma. the exposure should vary from three to eight seconds in the anterior and eight to fifteen in the posterior, depending on the film used. The resultant radiogram is thin and 'contrasty' but not under-exposed."

In many cases a single radiogram is not enough, but exposures must be made from many angles, and, of course, diagnosis cannot be made from the radiogram alone, though often the worst possible conditions remain undisclosed until the x-ray is resorted to.

The man attempting oral diagnosis should have the benefit of clinical experience in general practice and that coming from observation of oral surgery. He should from his radiographic study be able to recognize such variations "as mark the anterior palatine foramen and fossa and median suture; the nasal fossae; the canine fossae; the antrum; and the posterior palatine foramen; and the shadows of the malar and coronoid processes in the maxillae; the incisive fossae; mental foramen; inferior dental canal and mylohyoid grooves in the mandible."

An accepted nomenclature is a great need at present and several suggestions are made by the writer. *Radiolucent* and *radiopaque* are preferable to "rarefied areas." The latter presupposes bone destruction.

"Periodontitis, alveolitis, granuloma, abscess, cyst, are logical and easily understood when designating progressive pathologic changes in the area around the tooth root. *Hypoplasia* and *hyperlasia* are preferable to "absorption" and "hypercementosis", also "exostosis". *Osteogenesis* is preferable to "regenerating bone."

If radiolucence is found in areas having a past history of pathology, and the requisite period for osteogenesis has passed, then residual infection may justly be suspected.

Radium in Intra-Oral Cancer. Douglas Quick, M.D., Urologic and Cutaneous Rev., 27:219-224, April, 1923.

THE AUTHOR'S summary is as follows: "In the treatment of intra-oral carcinoma we believe two distinct problems are presented: (1) Treatment of the primary growth. (2) Treatment of the cervical lymph nodes.

"In the treatment of the primary growth, radium alone is the agent of choice. Technique must be varied to suit the needs of the different groups of cases and of the individual case. An appraisal of the case should be made when treatment is instituted, and the plan of treatment varied, depending upon whether a complete regression or only palliative relief can be anticipated. We believe that this procedure offers a hope for complete regression in a larger number of cases than does surgical removal. We also believe that it offers a vast amount of palliative relief to that large group of cases otherwise doomed to opiates alone.



"In the treatment of cervical lymph nodes we believe that the combination of radium and conservative surgery eliminates a large number of needless operations, and in those cases where extension of the disease to the neck is demonstrable there is a better chance of eradicating it than by the surgical procedure alone.

"In many of the inoperable necks it offers a considerable measure of palliative relief.

"Finally, we believe that this method of treatment of intra-oral carcinoma will ultimately tend to increase the confidence of the public in general so that patients with suspicious lesions will present themselves early in the course of their disease for advice and treatment."

A Clinical and Pathological Study of Tonsils Subjected to X-ray. Charles R. C. Borden, M.D., Boston M. & S. J., 188:493-497, April 5, 1923.

A TOTAL of fourteen cases was radiated, the tonsils afterwards being resected. Dr. Paul F. Butler radiated the tonsils according to the Witherbee technique. Dr. Frank B. Mallory prepared and studied microscopically the resected tonsils, and Dr. Frank L. Richardson administered the anesthetic for operation. The conclusions drawn from this study are as follows:

"Fourteen cases of diseased tonsils x-rayed from one to four times failed to show any clinical or pathological changes as a result of the radiation except as follows:

"During the times the radiations were being given, many of the tonsils seemed to be smaller and more normal in appearance, but when subsequently removed by dissection no real change in size appeared to have taken place.

"After radiation many of the tonsils appeared to be normal in size and color, but at the time of the operation a number of them were found to be filled with pus or cheesy debris. I regard this to be the most important information gained from our work in this series of cases.

"As a method of reducing bleeding and assisting dissection at the time of operation radiation is useful.

"By diminishing over-secretion from the mucous surfaces of the throat it decidedly decreases the possibility of postoperative pneumonia or lung abscess following throat operations.

"In cases where diseased tonsils may be justly suspected of producing secondary infections in the joints, heart, kidney or other important organs x-ray radiations are inadequate."

The histological picture in all of the tonsils was found to be that of a mild

inflammatory process with hyperplasia of the lymphoid elements.

Although the author regards the method as a valuable preoperative adjunct he believes it is impractical, as yet, owing to several facts, namely, the danger attendant upon any but expert radiation, the cost of the apparatus, and the psychological factor involved, that is, patients cannot see the use of radiation plus operation.

To Prevent Loss of Radium. B. B. Kirklin, M.D., Hospital Management, 15:41, March, 1923.

THE FOLLOWING suggestions were adopted by the Home Hospital at Muncie, Indiana: Only graduate nurses, especially the floor supervisor, are permitted to remove and handle radium, and such individual is responsible for seeing that the radium is replaced in the safe. When the radium is applied to a patient a tag printed in red letters bearing the legend "Radium, Do Not Destroy," is tied to the end of a string fastened to the radium. A red tray is provided, and only one red tray allowed in the hospital, this tray is used for radium or radium dressings and instructions are given that it is never to be emptied without first being sure that it contains no radium.

Report of the Safety Committee Presented at the Los Angeles Meeting of the American Roentgen Ray Society. Am. J. Roentgenol., 10:246, March, 1923.

THE DANGER from high tension shock is the phase of the subject which this report covers. The report is submitted by Drs. G. W. Holmes, P. M. Hickey, W. D. Coolidge and H. K. Pancoast and reads as follows:

1. X-ray equipment should not be installed or operated in low-ceiling rooms with overhead piping, or in damp or poorly ventilated rooms.

2. Floors should be covered with cork or other insulating material.

3. Footswitches should not be used in any radiographic work.

4. All diagnostic operating switches should automatically and positively open when released.

5. Double scale millimeters should be eliminated.

6. Two millimeters in series should be used in treatment.

7. All x-ray apparatus should be equipped with quick acting circuit breakers, preferably of double pole type. These should open with certainty on a 20 per cent overload. Circuit breakers should be tested at least once a month and a permanent record kept of these tests. Properly rated fuses should be used in addition to circuit breakers.

8. Where overhead high tension lines are used they should be of metal tubing not less than one-half inch in diameter. They should be firmly mounted and extend to the transformer or rectifier terminals.

9. High tension reel wire should be of fine braided enameled copper without cloth covering, strong enough to stand a pull of not less than 50 pounds weight.

10. High tension reels should be firmly mounted and have proper winding guides to prevent catching when winding, and sufficient tension to wind up against a pull of one pound weight.

11. Vertical and horizontal fluoroscopes should be so enclosed by insulating materials as to prevent operator, patient or assistants from approaching within sparking distance of any part of the high tension system. Metal screens should not be used if the fluoroscopic table permits the use of a tube over the patient.

12. In every installation the operating switch should be so placed that a full and unobstructed view is had of the high tension line to be used. If lead glass windows are provided they should be large enough to insure such a view.

13. All tables used for treatment with the patient between the tube and the table should be made of insulating material, unless the tube and terminals are enclosed in a permanent grounded case. No spring mattresses should be allowed.

14. Tables used for radiographic and fluoroscopic work should be of insulating material when practical, and the handles of all switches and diaphragm controls should be of such material.

15. When tubes in more than one room or booth are to be operated from the same transformer, provision should be made so as to make impossible simultaneous operation or closure by any one not in direct charge of the tube or line used. This may readily be accomplished by suitable interlocking switches or otherwise.

16. All bedside or portable outfits should have their high tension lines so placed that they permit of doing bedside work without having their wires come nearer to the patient than the tube terminals.

17. No treatment apparatus should permit any part of the high tension system to come closer to the patient than double the operating spark-gap, unless protected by a suitable insulator.

18. Permanently placed grounded metal screens between the tube and the patient are permissible and advised where the spark-gap exceeds ten inches.

19. Machines for high voltage therapy should be so designed that

their milliamperage on a short arch discharge is not more than 50 ma.

"In conclusion, the committee recommends that in view of the constant and rapid changes taking place, both in the application of x-ray and in the manufacture of apparatus, a board be appointed to which questions having to do with the dangers incident to the use of radiation of short wave-lengths and the apparatus used to produce them can be referred. It has seemed to this committee that this subject is too large and is changing too rapidly to be covered in any one report, and that it would be better to take up individual problems as they arise."

Possible Dangers in Connection with the Use of X-rays and How to Avoid Them. John S. Shearer, Ph. D., Am. J. Roentgenol., 10:240-245, March, 1923.

THE NATURE of accidents reported is classified under 19 heads in this paper, written by the late Professor Shearer. In the abstract the nature of the accident is printed in italics and the remedy given is printed in Roman type following.

1. "*Accidental closure of low tension switch.*—Would not occur if it were necessary to perform two voluntary acts each time an exposure is made and all switches were self-opening. Thus a latch device that has to be held out before a switch can be closed, and a spring opening the switch when the hand is removed would make closure deliberate in all cases. Push button switches should have a stop making pressure at two points necessary for operation.

2. "*Short circuit of foot switch or locking in position.*—No foot switches should lock closed, or have such weak springs as will permit a slight pressure to close them. All breaks should give a clearance large enough to avoid possibility of arc or accidental bridging.

3. "*Leaving low tension switch closed and attempting to adjust tube or reels.*—Would not happen if the suggestions in No. 1 were adopted and the operator was obliged to stand where there is full view of the tube, patient and high tension line. Lead glass windows if used should be large enough to permit such a complete view.

4. "*Coolidge filament wires hanging too low.*—If overhead tubing is used Coolidge wires should be drawn inside of one tube and reels should be firmly supported.

5. "*Breaking of reel wire and the end attached to the tube falling on the patient.*—The flimsy reel wire, often only common tinsel, so commonly used, is inexcusable. A braided tube over a twisted center made up of very fine

enameled copper wire is at once strong and flexible.

6. "*Attempting to set a double scale millimeter when operating switch is closed.*—No double scale millimeters should be permitted. For treatment a 0 to 10, for radiography a 0 to 100 scale covers all needs. This would avoid danger of changing during operation and of treating with an improper scale setting.

7. "*Failure of high tension insulators.*—A noteworthy example of this was seen where a hard rubber insulator passed through a lead box on a vertical fluoroscope. The fluoroscope was mounted on wooden castors. The lead was left sharp edged around the rubber and by corona action finally broke through. The discharge passed from the lead box to the metal diaphragm handle to the observer and thence to the floor. Micanite tubes, or hard rubber tubes with a thin inside metal tube would prevent such an accident.

8. "*Crossing on high and low tension lines.*—This means improper installation or loose wires hanging where contact is possible.

9. "*Failure of insulation of low tension circuit.*—A switch opening only one side of the power line was opened under conditions giving a heavy surge. This broke through the primary insulation in such a way as to leave a small primary current still passing. All circuit breakers and switches should break both lines, that is, be of the double pole type.

10. "*Bringing the tube too close to the patient.*—No arrangement of ordinary apparatus will protect a patient from a careless operator.

11. "*Leaving wires too close to the patient.*—Same as No. 10. Reels should always keep wires taut.

12. "*Spark-over due to surge.*—This may exceed ordinary operating or spark-gap voltage.

13. "*Failure to shift high tension switch to proper side before closing primary.*—Only one connection should be possible at a time and the operator should be able to close the circuit only when in a given position.

14. "*Breaking of overhead line.*—Poor construction to be avoided.

15. "*Attempting to measure spark-gap with a ruler when power is on.*—A careless procedure. A well insulated handle and a proper scale should be provided.

16. "*Discharge to diaphragm control due to slack reel wire.*—Poor reels or worn covering. See reel wire above.

17. "*Spark in primary insulation cutting out part of the control and thus causing unusually high voltage.*—May give a much greater voltage than intended.

18. "*Unusual spark-over due to failure to close filament circuit on a resistance controlled machine.*—On large machines the Coolidge filament should light when the motor switch is closed.

19. "*Contact with unused connectors or reels, sometimes in rooms where one has no information as to whether high tension is on or not, viz., fluoroscopic room separate from the radiographic room and operated by a transformer in the latter.*—A dangerous practice."

This list does not exhaust the possibilities. Some of the accidents here listed were fatal and all were painful. The author adds that the practice of making dental radiographs in the ordinary dental chair is a dangerous one. Wooden chairs well insulated should be used.

The prevalent idea that if grounds enough are provided everything else may be neglected is a much mistaken one. The grounding may even be a source of danger, e. g., if one touches a high tension line.

The following testing devices are given: "What regions are in danger of spark-over to the operator or patient? Place a metal plate or water in a metal pail on the floor. Insulate a millimeter and connect one terminal to the plate or the water, fasten a piece of flexible wire to a dry stick about three or four feet long and approach it to various parts of the apparatus when in operation. The spark distance and the milliamperage reading will give a fairly good idea of the danger if the body replaced the wire.

"Test overhead systems by hanging a weight on the middle portion considerably in excess of the pull of the reels when fully extended.

"Millimeters in series should give identical readings. This test is easily made.

"Line leakage in therapy can be tested by putting one millimeter close to the tube and the other close to the transformer. When a meter near the transformer reads 5 ma. and 0.5 ma. less near the tube, the error is considerable. Leakage is always greater at higher voltages."

A Method for the Opaque Meal Examination of the Stomach. S. Gilbert Scott, M.R.C.S., L.R.C.P., Arch. Radiol. & Electroth., 27: 304-315, March, 1923.

THE AUTHOR believes that the time will come when every gastric lesion of organic nature may be detected by the opaque meal examination. Practical experience and extremely careful observation are required to make this at all possible, and the radiologist must always remember that often the decision for or against operation de-

pend upon his diagnosis, and unless the evidence is unmistakable it is his duty to state that it is weak or uncertain or incomplete.

The methods in use in America, on the continent and in England are compared. All methods have been used by the author, but he prefers his present technique to any other one, as for the past three years he has secured a correct diagnosis in 94 per cent of cases where it has been tried.

Systematic, radioscopic palpation, inch by inch, is done, and this must be done rapidly and accurately, which practice will make possible. The ordinary "prodding" called palpation will not do.

Clinical history too often is unreliable and misleading and in general it is not necessary to the radiologist who is better off without it, as his judgments will then be independently made. Radiographs are of only secondary value, small ulcers may be missed thereby. Radioscopic palpation will reveal any lesion that a radiograph will reveal. If the radiologist cannot be present at operations, then report sheets made out by the surgeon and giving the particulars of the condition found should be provided the radiologist, so that the accuracy of the radiological diagnosis in each case may be checked up by him. If this is not done he will miss many a thing that would increase his knowledge and power.

Thirty-six to forty-eight hours before examination the patient is given castor oil or some other vegetable purgative and is put on a light diet, but not starved. Unusual hunger has a definite reflex effect on the behavior of the stomach.

Barium sulphate is difficult to administer in a palatable form and the author uses a barium cream made up in three thicknesses, the formula for which is as follows:

#### No. 1—Thick Flavoured

Barium sulphate.....10 ozs.  
Saccharin.....2 grains  
Vanillin.....5 grains  
Gum tragacanth.....100 grains  
Distilled water to.....20 ozs.

#### No. 2—Thin Flavoured

Barium sulphate.....10 ozs.  
Saccharin.....2 grains  
Vanillin.....5 grains  
Gum tragacanth.....60 grains  
Distilled water to.....20 ozs.

#### No. 3—Thin Unflavoured

Barium sulphate.....10 ozs.  
Gum tragacanth.....60 grains  
Distilled water to.....20 ozs.

The gum and barium are mixed to a powder and the water gradually added and all is then sterilized. The cream is better if made by a chemist and it

may be used for injections into the sinuses also, as it is sterilized.

The cream throws a dense homogeneous shadow and readily penetrates into every crook and crevice. Three to four ounces are first given, and followed by six ounces or more if necessary. The rate of emptying is influenced by so many unknown factors that it is regarded as of little diagnostic value. Mechanical narrowing of the pylorus or duodenum sufficient to cause delay should easily be detected at the first examination. The double meal method may lead to error and is not in favor with this author, and if it is used extreme caution must be observed for "the evidence of a gastric ulcer may depend upon a very small fleck lying close to the stomach shadow. If an opaque meal, or even bismuth mixture has to be given to the patient some hours previously, it is quite possible for a small quantity of this to be seen lying apparently in the stomach area, resembling an ulcer crater, although actually it is in the small or even in the large intestine."

Concentration of the radiologist upon the task at hand is very important and it must be aided by perfect organization and comfort. Outside disturbances, noise, delay—all should be eliminated. Comfort assists concentration and is well worth securing, for it saves mental fatigue and wasted nervous energy. An upright diascope will enable the radiologist to sit in comfort and to use both hands without being cramped and also to get at the patient, moving him in any direction desired without any word of command being necessary.

Expedition and accuracy will be gained by systematic examination. A definite order of routine should be followed in all fluoroscopic work and should be persisted in since, for instance, the presence of a chronic gastric ulcer does not exclude the possibility of a duodenal ulcer.

Apparatus should be simple. The fluorescent screen for gastric examinations should not be larger than eight by ten inches and it should be the best on the market. The patient must have full support to lean on, a metal cylinder eight inches long fixed to the face of the diaphragm is used by the author. There must be enough space between the back of the screen and the front of the patient for the hands to palpate and there should be provision for placing a cassette near at hand so that a radiograph can be easily and quickly taken if desired.

For protection, thick lead around the tube, an extra thick lead for the face holding the diaphragm, and diaphragm shutters of lead and iron should be used. Two sheets of the best lead glass

should be placed over the screen and specially, protected gloves, light and supple, should be used. The patient should be protected by a filter of aluminum over the diaphragm. The distance between the tube and the screen should not be less than thirty inches. Minimum current should be used and sufficient earthing employed. Before new apparatus is used it should be tested with a fluoroscopic screen or otherwise. If these precautions and measures are used the method is perfectly safe.

Rough handling may set up spasm of the stomach and close the pylorus, therefore palpation must be gentle and should be done with the flat of the fingers, not the tips. Both hands should be trained to work in conjunction.

As to position of the patient, with a properly arranged diascope a much better view is usually obtained with the patient standing, but without this diascope both upright and horizontal positions must be employed, the patient lying on the right side to permit a view of the pylorus and the duodenum, though the degree varies with different individuals. In drinking the cream the patient should hold the cup in the left hand to avoid contact of elbow and screen. "Without manipulation the cardiac end of the stomach cannot be distended to the same extent as the lower segment, no matter what quantity of the meal is given.

Minute directions for palpation are given. Patience and practice will prove the diagnostic value of the method and the author is of the belief that the value of radioscopy in gastric work will soon prove itself greater than that of radiography.

Duodenal Ulcer. Maurice F. Dwyer, M.D., Northwest Med., 22:122-126, April, 1923.

DIAGNOSIS depends upon clinical history, carefully obtained, and upon the proper interpretation of x-ray findings. The author in his summary says: "With a typical history of ulcer it is possible for the clinician alone to diagnose accurately approximately 80 per cent of duodenal ulcers. Fourteen of the ulcers in this series would not have received a definite diagnosis had it not been for the x-ray findings. The clinical diagnosis in those presenting a typical history was fortified by confirmatory x-ray evidence. Persistent deformity of the duodenal bulb found on re-examination, after obtaining full physiologic effects of an antispasmodic, is the most important sign in the diagnosis of duodenal ulcer. This statement was proved at operation to be correct in 93.5 per cent of cases diagnosed duodenal ulcer by the roentgenologist. The value of the negative x-ray



findings in excluding ulcer was even higher. We have record of only one ulcer not diagnosed by the x-ray which was found in approximately three hundred operated cases in which the duodenum was examined. All patients complaining of gastric symptoms should receive a routine clinical examination before being referred for roentgen study, as 88 per cent of such patients have lesions other than those of the stomach and duodenum. Roentgen diagnosis is a branch of internal medicine. The roentgenologist and clinician must work in unison. Each is indispensable to the other in arriving at the ultimate diagnosis."

**The Clinical Importance of the Chronic Changes in the Appendix which are Discovered by the Roentgen Ray.** Franklin W. White, M.D., Boston M. & S. J., 188:587-583, April 19, 1923.

**WHAT** are the signs of chronic appendicitis and how important are they to the individual? The author states that with the rare exception of tuberculosis there are no chronic inflammations of the appendix, though there may be chronic changes which may cause functional changes.

The direct x-ray signs are tenderness, fixation, kinking, changes of shape, abnormal position, lack of filling, slow emptying, beading, also adhesions in the ileocecal region. Indirect signs are pyloric spasm, gastric residues and ileal stasis.

At six hours the barium meal is scattered in the coils of the ileum and the appendix cannot easily be seen. Twelve hours and onward from that period are the best periods to make the examination. Sometimes the best time is found to be even 48 hours afterwards. Fluoroscopic examination is made with the patient lying on his back.

The value of the x-ray regarding tenderness consists in sharply localizing the pain. Though most normal appendices are not tender, the tenderness is subjective and should not be regarded as absolutely indicative of disease, adhesions, etc., must be considered along with the tenderness.

As to filling authorities differ. George says an appendix which does not fill is pathological, while Skinner says an adult appendix which does fill is pathological. Cohen says the appendix may fill and empty several times during the passage of an opaque meal. Partial filling may give only a faint outline. Though nearly all pathologists agree that obliteration indicates disease the author would not take it by itself as a positive sign of pathology.

The various reports concerning the results from different meals the author

regards as due to a varying care in examination more than to any difference in the form of meal used.

Filling may be irregular, interrupted, beaded or segmental, or may show fecal masses. Beading, the author believes, may result from haustration or the drying out of the contents of the appendix, and is probably due to purely physical causes. Filling around fecal masses, showing like peas in a pod, is usually indicative of disease.

The normal appendix will empty in from 24 to 36 hours. If it has not emptied soon after 36 hours or soon after the cecum is empty then pathology is suspected.

Fixation or kinking must be permanent to have any bearing in diagnosis. Kinking and angulation also is usually due to adhesions, narrowing, scar tissue, and obliterative changes.

Large size alone is not indicative of anything abnormal, as the size varies with muscular tone and personality. Any change of form must be constant to be regarded as of any diagnostic significance.

The position of the organ may vary greatly if it is free, as it is very movable. It often is found five or six inches from McBurney's point.

Of ileal stasis the author has this to say: "In weak, sick or old people there is often delay all along the line, the stomach, ileum and colon. Don't stress ileal stasis in such cases as these; in the atonic, ptotic cases are made most of the mistaken diagnoses."

Pyloric and duodenal spasm and gastric residues are not regarded by the author as reliable diagnostic signs of chronic changes in the appendix and are only met with about one time in 12 or 155. Incompetent ileocecal sphincter has even less diagnostic value.

X-ray evidence alone may show many unsuspected things about the appendix—often things which need not bother the patient very much. The most important of the signs are tenderness, constant changes in shape, fixation and abnormal position—the less important ones are filling and emptying and signs of fecal residue.

**The Roentgen Diagnosis of Ulcus Duodeni with Respect to the Local Direct Roentgen Symptoms.** Aeke Aekerlund, M.D., Stockholm. *Acta Radiologica*, 2:14-30, No. 5, 1923.

**I**N THE diagnosis of duodenal ulcer schematic procedure never leads to the goal and a capacity for individualization and for patience is requisite for good results.

In Stockholm there has been worked out a technique which shows the influence of many different techniques in

use over the world. The method is not wasteful of time nor is it very expensive; 15 to 30 minutes suffices for examination and three plates, 18 by 20 cm. are sufficient to take all the pictures needed.

Intimate cooperation between fluoroscopy and roentgenography is a part of the method. By the former the efforts to fill the bulb are controlled, and the degree to which it is filled is determined, as is also the right moment for exposure and the directions for projection. A thin well mixed opaque meal is used. If the bulb does not fill of itself after a reasonable length of time it may be aided by manual expression of the stomach contents, by use of the right lateral position (especially in fat patients), or by blocking of the pars inferior duodeni. The arrangements for the exact adjusting of small plates and for taking small serial pictures of the duodenum in different positions of the body are described thus:

"Between the patient and the fluorescent screen I use a cassette holder consisting of a pasteboard sheet or a wooden plate inserted in a thin steel frame. On this cassette holder the required picture surface is marked under fluoroscopic control by a couple of adjustable metal bands that can easily and conveniently be shifted as required from the margins of the cassette holder. When the cassette holder has been fixed in relation to the patient the fluoroscopy is broken off and the fluorescent screen is removed with a single manipulation and by means of a spring on the cassette holder a plate is fixed quickly and precisely in the place of the fluoroscopic picture. In this way an exposure can be made—as needed sometimes—a second or two after the breaking off of the fluoroscopy.

"For the taking of serial pictures I make use of a particularly simple arrangement. To expose four pictures on every plate only one lead sheet is required of 1.5 mm. thickness and of suitable size, furnished with a central square window the size of which shall represent exactly a fourth of the plate employed. The plate is shifted by hand in relation to the lead window between each exposure and is fixed in the different positions by a spring; a fourth of the plate is exposed each time, situated in one of the four corners of the plate. For most cases a plate of 18 by 24 cm. in size is quite sufficient for such serial pictures, as each picture will be 8 by 12 cm. At the adjustment for serial roentgenography in standing position the lead sheet is first fixed to the cassette holder with the window either standing (vertical) or recumbent (horizontal) after which the cassette holder is adjusted under fluoroscopic control

so that the bulb appears exactly in the middle of the lead window; the exposures are then made at desired speed. For my own part, I generally expose the different pictures in a series with about one-half minute's interval.

"Serial pictures ought to be able to be taken in every position required; for serial photographs in various recumbent positions only a wooden tunnel is required with a lead window on the surface turned towards the patient.

"Respecting the technique, it may be further added that the time for exposure must be so short that the pictures become sharp; in other words, it should not exceed 0.4 to 0.5 seconds.

The following paragraphs are copied from a summary of the article appended to the original paper:

"The changes in the form of the bulb constitute the central point in the direct roentgen diagnosis of the duodenal ulcer. The author distinguishes four kinds of ulcer deformities in the bulb: niche, defect (retraction and diverticulum.

"According to the author, the bulbar niche is by no means rare. Out of material of about 100 positive cases of duodenal ulcer, collected during the course of two years at a hospital, he observed the niche symptom in the bulb in rather more than 60 per cent.

"The bulbar niche is most often localized to the lesser curvature side, which is retracted. As a rule, a local, circular and often spastic constriction (defect) occurs in the niche plane from the greater curvature side. The bulbar deformity hereby arising which may be called a miniature picture of the ulcer deformity of the stomach, constitutes in the author's opinion the most typical ulcer deformity in the bulb and has been confirmed by him in more than 50 per cent of the above mentioned cases.

"The author ascribes a certain importance to the spastic, circular bulbar constriction in the ulcer plane, which usually appears more marked during the later stages of digestion, in respect to the cause of the paradoxical four hours retention by uncomplicated duodenal ulcers with initial hypermotility and very likely also in respect to the origin of the typical hunger pains.

"The spastic shortening (retraction) of the longitudinal muscles, which are particularly strongly developed in the medial bulbar region, and which may result in a pyloric insufficiency directly observable in the roentgen picture, offers a mechanical explanation of the initial hypermotility.

"Among the differential-diagnostics important affections the author especially mentions those of the gall-bladder and new growths of the bulb.

"The author's statistics from operative and postmortem material show correct roentgen diagnosis in rather more than 60 per cent; correct diagnosis of probability in a further 20 per cent. In the remaining cases it was not possible to make a roentgen diagnosis or it was only made alternatively. The roentgen diagnosis was obviously incorrect only in 5.6 per cent of the total number of cases."

The Role of Radium Needles in the Treatment of Neoplastic Diseases. William L. Clark, M.D., *Am. J. Roentgenol.*, 10:204-208, March, 1923.

IN HIS introductory remarks the author says that the radium therapist, in addition to skill, must be broad enough of vision to recognize the importance of other forms of treatment and he specifically mentions operative and electrothermic treatment.

In using radium needles the dosage is very important, and it is also very difficult to estimate. The anatomical localization of the lesion, its type, and the grade of malignancy involved are factors governing the dosage and great harm may result to the patient if ignorance regarding these factors exists.

The needles must be used guardedly near bone. When 10 mg. needles are inserted into malignant tissue the distance should be not greater than 25 mm. It is inadvisable to employ needles a second time after a maximum dose has been given with them, since the tissue may break down. However, x-rays or radium may be safely used on the surface. In localized basal cell epitheliomata or in localized malignancy of any type the author does not use the needles if electrodesiccation or electrocoagulation or surgery can be used to destroy the disease at once. If these methods are not possible, then the needles are employed.

In the discussion following the reading of this paper, Drs. Kirkendall, Pancoast and Clark endorsed the practice of sterilizing the needles by boiling. Dr. Bowing advised against withdrawal of needles by thread, as it cannot be sufficiently sterilized. He advised a fine resistant wire for this purpose. Dr. Aikins said that he preferred flat applicators to needles.

Statistics and Technique in the Treatment of Malignant Disease of the Skin by Radiation. Howard Morrow, M.D., and Laurence Taussig, M.D., *Am. J. Roentgenol.*, 10:212-213, March, 1923.

THE TECHNIQUE of treating basal cell epitheliomata, squamous cell epitheliomata and the various types of cutaneous sarcomata is discussed and

statistics from 371 cases are presented.

The authors state that their experience convinces them that radium therapy combined with other methods is the most satisfactory way to treat cutaneous malignancy in appropriate cases.

A Report of Two Cases of Malignancy in Xeroderma Pigmentosum and Their Response to Radium. E. P. Pendergrass, M.D., and I. S. Ravdin, M.D., *Urologic and Cutaneous Rev.*, 27:207, April, 1923.

RADIUM and electrothermic coagulation was used in the two cases of malignancy here reported. It is from the viewpoint of the malignancy that the results are tabulated, as radium has no effect upon the other condition.

The two cases are clinically well today. A distinct change was visible within a week in both these cases, and in the one case which had metastatic glands these disappeared.

Epithelioma of the Eyelids. Douglas W. Montgomery, M. D., and Geo. D. Culver, M.D., *Urologic and Cutaneous Rev.*, 27:205-207, April, 1923.

GROWTHS involving the inner canthus of the eye, when treated with radium, clear up with remarkably little interference with the lacrymal duct. Seven such cases are reported, the outline of the reports is as follows:

1. May, 1918. Patient aged 59 years. Recurrent growth. Condition still excellent.

2. October, 1918. Patient aged 81 years. Fourteen years since first appearance of growth, which now involved the orbital cavity. Complete relief from pain, but, of course, not cured.

3. No date given. Patient aged 79. Growth spreading over glabella. Readily controlled.

4. May, 1920. Growth of eight years duration and rodent type involving the edge. Result: delicate scar tissue, lower lid cannot fully close. No sign of recurrence February, 1923.

5. January, 1921. Patient aged 62. Ten years duration, ulcerated for two months. No sign of recurrence February, 1923.

6. No date. Patient aged 70. Ten years since first appearance of growth. Healed without trace.

7. February, 1922. Patient aged 63 years. Growth extending deeply into canthus. Condition excellent November, 1922, when last reported.

Epithelioma of the edge of the lid is reported in seven cases. In one of these cases the growth was of the upper lid. All were treated with radium and all have remained healed throughout periods varying from five years to a year.

Another case had a large flat rodent epithelioma which involved the cutaneous surface of both lids and extended into the cheek. This growth invaded the palpebral conjunctiva at the external angle where there was an extropian. The author remarks that the conjunctiva is very resistant both to invasion and to deleterious effects of electro-magnetic energy and is not easily burned as is the mucous membrane of the mouth and rectum. This particular case was cleared up without any impairment of the function of the lids and has remained well since October, 1920.

Excellent cosmetic and functional results have been secured by this author and he believes that radium treatment decidedly lessens the danger of recurrence in these growths.

The Treatment by Radiation of Cancer of the Rectum. Harry H. Bowring, M.D., and Frank W. Anderson, M.D., *Am. J. Roentgenol.*, 10:230-239, March, 1923.

THE AUTHOR'S summary of this paper reads as follows: (1) Radium, if properly applied, causes a definite inhibitory and destructive effect in the majority of neoplasms of the rectum. (2) Sufficient evidence is available to prove that radium is a valuable adjunct when added to our present surgical measures in the treatment of cancer of the rectum. The closest co-operation between surgeon and radiologist is essential. (3) In order to give the best possible individual treatment and to avoid discredit of either surgery alone or surgery and radium and roentgen ray, an abdominal exploration should be made, except in gross inoperable cases. (4) Following exploration which determines inoperability with little or no low obstruction, it is not essential to make a colostomy in order to give the radium and roentgen ray treatment as outlined. Observation at intervals of from six to eight weeks is essential for the purpose of determining the advisability of radical operation. (5) The majority of patients with gross inoperable lesions should be given the benefit of the radium and roentgen ray therapy. A colostomy should be made at the first sign of impending obstruction. (6) The majority of patients receive inadequate treatment. It is impossible to give intensive treatment to some patients because of their general condition and because the entire tumor cannot be exposed. In patients with a colostomy, the growth should be treated through the distal loop. If the mass can be palpated by digital examination of the vagina this cavity should be packed with radium in close proximity to the rectal tumor. (7) Early diagnosis is paramount. A digital examina-

tion should be made routinely of all patients. An early protoscopic examination by an inexperienced physician is better than a late examination by a proficient proctologist. Microscopic examination is of definite value in early cases and will help to classify the cases, as well as to furnish a basis for prognosis when patients are operated on. (8) Some neoplasms of the rectum respond readily, while others are resistant to radium and roentgen rays. Long survival is possible in untreated cancer of the rectum. Our conclusions must be guarded until a large series of cases is available and sufficient time has elapsed. (9) Since radium in larger quantities and high voltage roentgen ray equipment are at present available, a combination of these is the most ideal method for radiation therapy, and results should be better."

The Treatment of Carcinoma of the Uterus, with Special Reference to Surgery, X-ray and Radium. Henry Schmitz, M.D., *Northwest Med.*, 22:77, March, 1923.

THE SUCCESS of any method in dealing with this lesion depends upon a correct diagnosis, which must include a clinical and histologic diagnosis and also a determination of the extent of a neoplasm within the body.

The author thus summarizes his paper: "(1) Cervical carcinomata must be grouped for purposes of prognosis and treatment. (2) Careful statistics must be kept to establish the efficiency of the treatment. (3) Studying the grouping and the treatment we may establish the following rules for treatment: (a) Localized carcinomata, associated with grave constitutional diseases, should be treated by a panhysterectomy. (b) Border-line and clearly inoperable, and operable but complicated cases should be treated by a combined full dose of gamma and x-rays. (c) Advanced and recurrent cases should be treated palliatively by x-rays or radium. (4) Radiation therapy should not be preceded or succeeded by surgical therapy. The latter is not only unnecessary but decidedly diminishes the good results observed after radiation therapy. (5) Repetition of a course of radiation treatment is not advisable. It will not improve the results of the first treatment and almost invariably will be followed by severe and permanent issue injuries."

Exact Localization of Renal Calculi by Roentgenography of the Profile of the Kidney. Drs. Bazy and Lazarenne. *Bull. et mem. Soc. de chir. de Paris*, 49:400-409, No. 9.

THE ordinary roentgenography of the kidneys does not permit the visual-

ization of the superior poles, especially of the right side.

Using the Carelli method of perirenal insufflation we get a very distinct image of the kidney with its superior pole, but a roentgenogram was thought obtainable only in the anteroposterior position. A profile projection has also been thought to be impossible because of the fact that the two kidneys with the spinal column are in the same line with those shadows, consequently superimposed upon one another.

The authors, however, found that a perirenal insufflation as in the Carelli method makes the kidney float in the free space caused by tension of the air in the capsule. The peritoneum is pushed forward and the kidney retained only by its vascular pedicle floats freely, and with slight forward rotation of the patient it is displaced forward and thus isolated from the other kidney and spinal column which remain posteriorly. A number of views must be made before a perfect profile image is obtained.

The advantages of this method are incontestable, according to the authors, in (1) permitting the study of the kidney on its several faces; (2) in differentiating renal calculi from those of the gall-bladder; (3) in localizing exactly the position of such calculi in the same manner as projectiles are localized by having two axes.

The authors used 300 c.c. of oxygen which they injected into the perirenal capsule by the Carelli method.

The accompanying prints are very clear and helpful.

A. M. PFEFFER, M. D.

X-ray Studies on Cardiac Diseases in Children. W. Morgan Hartshorn, M.D., and C. Winfield Perkins, M.D., *New York M. I. & M. Rec.*, 117:268, March, 1923.

THIS ARTICLE, freely illustrated with radiographs, presents the following conclusions:

1. The x-ray examination in cardiac diseases of young children is of material aid in confirming physical signs.

2. It presents an accurate method of differentiating normal from abnormal hearts in children at different ages.

3. Progress of the disease may be noted by successive x-ray examinations.

4. At all ages in the normal, there is a constant ratio between the transverse diameter of the heart and the transverse diameter of the chest.

5. As a method of differentiating between congenital heart disease and thymus disease it is invaluable.

6. Associated pathological conditions of the chest can be demonstrated.

7. Advanced cardiac disease is associated with marked increased peribronchial shadows, fanlike in character



confined to the upper lobes of the lungs.

8. Distortions in the shadow of the heart due to imperfect technique may simulate pathological conditions.

9. Successive x-ray examinations should be taken in the same positions at same distance and with the same exposure.

W. W. WATKINS, M.D.

Results of Treatment in One Hundred Consecutive Cases of Hyperthyroidism. Hugo A. Freund, M.D., New York M. J. & M. Rec., 117:395, April 4, 1923.

**THIS REPORT** covers patients treated over a period of two and a half years, the last treatment being more than six months previous. The series included functional, adenomatous and hyperplastic types of goiter.

The treatment varied according to the indications, seeking to bring about a reduction of the metabolic rate to normal. Regarding radiation, the author says:

"Ever since the destructive effect of the roentgen ray has been recognized, it has been used in one form or another in the treatment of thyroid diseases. Its valuable effects have been recorded at various times. However, only within recent years has a systematic study of such cases been pursued. The controlled use with definite dose of the x-ray has made such studies statistically reliable. Checked up by frequent basal metabolism studies, its effects can be so carefully observed that it forms a method of treatment both safe and simple. My conclusions from its use in one hundred consecutive cases, which have been under observation for from six months to three years, are that in the majority of cases it promptly and effectively destroys portions of the gland producing thyroid hyperactivity; that failure to give complete relief does not interfere with subsequent surgical removal of large hypertrophied adenomatous portions of gland and that its control places its value as a remedial agent far above the surgical method of removal of uncertain amounts of the diseased gland."

W. W. WATKINS, M.D.

Pathogenesis and Treatment of Exophthalmic Goiter in the Light of Our Present Knowledge. Alfred Gordon, M.D., New York M. J. & M. Rec., 117:385, April, 1923.

**THIS AUTHOR** discusses the pathogenesis of exophthalmic goiter and the treatment with regard to medical treatment, surgical treatment and radiotherapy. With regard to the surgical treatment he concludes that "the results of surgical intervention are various, partial or complete successes

may be met with as well as failures by all methods."

With regard to radiotherapy, he says weekly applications of x-rays to the lateral and median lobes are sometimes useful. Beclere advises continuous applications until the morning pulse is 80 and until there is increase in weight. The functional disturbances usually improve rapidly, but the thyroid and exophthalmos are the last to improve.

In the grave forms a trial of medications, together with dietetic and hygienic rules, hydrotherapy, electrotherapy and radiotherapy should always be considered and administered, and only in case of absolute failure is surgical intervention in several sances to be considered.

W. W. WATKINS, M.D.

Thyroid Diseases Benefited by X-ray Treatment. R. G. Allison, M. D., Journal-Lancet, 43:169, April, 1923.

**THIS BRIEF** article is a part of a symposium on thyroid diseases given before the Henepin County Medical Society and consisting of ten papers.

Twenty-seven cases of Graves' Disease without complications, whose treatment had been completed more than eight months, were reported. Twenty-four of these were well, clinically and from a laboratory standpoint. Three had come to operation, one of these showing marked improvement before operation. Six cases of postoperative hyperthyroidism were treated, only one showing improvement. Three cases of toxic adenoma were treated, none showing improvement.

The technique used was 30 ma., 10 inch distance, 4 mm. Al, 8 inch spark gap, and three portals, at three week intervals. If no improvement occurred by the fourth treatment, time was increased to 34 ma.

W. W. WATKINS, M.D.

Some Observations Upon the Histological Changes in Lymphatic Glands Following Exposure to Radium. I. C. Mottram, M. D., Research Dept., Radium Inst., London, Am. J. M. Sc., 165:469, April, 1923.

**THE CONCLUSIONS** drawn from the reported observations are made with diffidence, but with the idea of encouraging other workers to take up what appears to be a profitable line of investigation.

The reported findings would appear to be in opposition to the conclusions of Murphy, of the Rockefeller Institute, that small doses of roentgen rays or radium stimulated lymphocytic formation, the author's conclusions being that the apparent accumulation of lympho-

cytes following such doses is really due to a massing of dead and degenerated cells in the glands.

The histologic structure of the glands is discussed and the changes occurring after exposure to radium, the lymphopenia in the general circulation being coincident with the accumulation of degenerated lymphocytes in the glands. The endothelial cells of the gland follicles are assigned a phagocytic activity in the ingestion of the degenerated lymphocytes, and not their supposed function of producing lymphocytes by mitosis.

W. W. WATKINS, M.D.

Analysis of X-ray and Operative Findings in Eighty-six Abdominal Cases. C. Harvey Jewett, M.D., Clifton Springs, N. Y., Clifton Medical Bulletin, December, 1922.

**THIS** is a report of eighty-six cases of gastro-intestinal disease, diagnosed by x-ray examination and afterwards operated. The report is made to illustrate the percentage of correct diagnoses and to show the frequency of lesions not detected by the x-ray examination.

Six cases of gastric ulcer were diagnosed and all confirmed by operation.

Seven cases of gastric carcinoma were diagnosed; six were confirmed by operation, the other case being ulcer with adhesions to the transverse colon.

Ten cases were diagnosed duodenal ulcer, confirmation by operation in seven, the others being adhesions.

Eleven cases were diagnosed gall-bladder disease; stones were diagnosed in five, all confirmed by operation; stones were found in one other case, not shown by x-ray. Gall-bladder adhesions were diagnosed in the remaining six, verified in three cases.

Sixteen cases of appendiceal disease were diagnosed, with operative confirmation in all; half of these cases, however, showed associated lesions not diagnosed in the x-ray examination.

Twenty-two cases of intestinal adhesions were diagnosed and verified at operation, many of these showing more extensive involvement than the x-ray examination indicated.

The x-ray diagnosis was verified at operation in 84 per cent of the cases. In 19 per cent additional lesions were found, not shown by x-ray.

W. W. WATKINS, M.D.

The Roentgenological Symptom Complex of Horseshoe Kidney. N. Voorhoeve, M.D., Fortschr. d. Geb. d. Roentgenstrahlen, 30:201-210, Feb., 1923.

**CLINICAL** diagnosis of the presence of horseshoe kidney is usually very difficult. Rarely can one note on pal-

pation the presence of a bridge transversely across the spinal column connecting both lower poles of the kidneys as has been described by Israel and by Zondek. This is impossible to make out when the patient is too fat, or when the connecting bridge is too narrow, or when the bridge unites the upper poles. Also the anamnestic data are few and vague. Patients seek advice only when complications set in such as stone and pyonephrosis which occur in a greater percentage in horseshoe kidneys. Most of the roentgen examinations are made by the methods usual for the purpose of revealing ordinary pathology. The author had two patients sent to him for roentgen diagnosis of calculus, and whom he accidentally discovered to have horseshoe kidneys.

The author does not agree with the generally prevalent idea that only pyelography with palpation can demonstrate a horseshoe kidney, nor does he depend, as have some other investigators, upon the position of a stone in the median line or in the bend of the kidney. In his two cases he made a diagnosis by simple unaided roentgen examination.

In the first case, that of a man aged 40, the author found one stone in the right kidney and three stones in the left. The kidney outlines were strictly parallel with the spinal column, both were strongly median, almost on the spinal column, both were ptosed markedly and the degree of ptosis was markedly alike in both sides. This picture suggested the probability of horseshoe kidney.

Further examination showed that it was impossible to move the kidneys away from the median line; that they moved easily up and down, showing a change of position when taken in extreme expiration and in extreme inspiration. The connecting bridge could not be demonstrated, but due to this bridge running ventrally across the spine the lower poles of the kidney were naturally more ventrally placed than the ventral plane of the vertebral bodies, while in the normal they are found posteriorly to that level. The author found that the lower poles moved in the opposite direction in relation to the tube in ventro-dorsal direction of the rays, and in the same direction with the tube in the dorso-ventral direction of the rays, when compared with the spinal column. The case is just the opposite in the normal.

In a second case, a stout individual, 48 years of age, all previously mentioned symptoms were present in addition to a demonstrable connecting bridge which appeared as a cow horn on either side of the spinal column.

After operation, which consisted of the removal of the bridge with a portion of the left kidney, the specimen was roentgenographed and was found to represent the shadows in the original roentgenogram.

The tube position in the median line throws the outline of the inner border of the kidney somewhat more laterally and the complete rounded lower pole fails to appear. Often the portion of the bridge is demonstrated. The following paragraph summarizes the author's findings:

"Both kidneys are in vertical position, and their inner borders are parallel with the spine. They are in the median position, the distance between the inner border and the spine is abnormally small. There is double ptosis, often in the same degree in both sides; immobility of the kidneys in the mediolateral direction; apparent superimposition of the lower poles on the spine and movement in an opposite direction in ventrodorsal direction of the rays, and in the same direction in the dorsoventral course of the rays; eventual visualization of the connecting bridge.

A. M. PFEFFER, M. D.

Some Observations on Radium Therapy in Cancer at the Institute of Radium, Paris. Malford W. Thewlis, M.D., Rhode Island M. J., 6:39, March, 1923.

REGAUD'S technique is different from that which we are accustomed to observe; he and his collaborators were perhaps the first to use radiation of a feeble intensity prolonged over four, eight or ten days without interruption. He prefers the salts of radium to the emanation, as the radiation is much more constant with the former.

In cancer of the tongue, several sterilized needles are inserted into the tumor and into the healthy tissue at a distance of one and one-half cm. away from the tumor. These are left in place for eight days.

In cancer of the uterus a similar technique is employed, using emanation tubes in suitable containers, leaving the apparatus in place four to eight days, depending on the type of cancer present. They are removed daily for the purpose of giving a cleansing douche.

This treatment is based on the idea that the cells must be subjected to radiation during division stages, when they are most vulnerable.

W. W. WATKINS, M.D.

The Scope of X-ray Therapy in Naval Practice. E. L. Whitehead, Lieut., M.C., U.S.N., U. S. Naval Bull., March, 1923, p. 309.

THIS is a detailed review of the advances in radiotherapy within the

past few years, including apparatus, technique, biological effects and clinical application.

McKee and Andrews are quoted as giving a list of eighty skin diseases amenable to x-ray treatment, and many of these are reviewed, especially those most frequently found in naval hospital work.

Among the many and varied benign conditions in which radiotherapy is indicated as the treatment of choice are Hodgkin's disease, leukemia, mycosis fungoides, uterine fibroids, tuberculosis adenitis, selected cases of hyperthyroidism and hyperplastic tonsils.

The author states the situation with regard to the treatment of malignancy very aptly by saying, "In the treatment of malignant conditions lies, at once, roentgenotherapy's greatest triumph, greatest failure and greatest future." This field of work is yet in its infancy and the results so far secured justify hope of much greater success in the future.

W. W. WATKINS, M.D.

The Value of the Roentgen Ray in the Diagnosis and Prognosis of Sarcoma of the Long Bones. Henry W. Meyerding, M.D., J. Bone & Joint Surg., 5:323, April, 1923.

SUMMARY: The roentgen ray is one of the most valuable aids in the diagnosis and prognosis of sarcoma of the long bones. It reveals the location, size and extent, and to a certain degree, the structure and origin of the tumor and the presence of metastasis. It is the earliest aid in determining the presence of pulmonary metastasis, although the absence of demonstrable lesions does not mean that metastasis has not occurred. Roentgenograms of the lungs should be made as a routine measure in every case of suspected malignant tumor of the long bones, particularly if surgical removal of the primary tumor is contemplated.

Every injury to the bone or suspected lesion should be examined roentgenologically. Treatment with radium, the roentgen ray and Coley's toxin appears to be beneficial in the control of certain malignant lesions of the bone, but thus far none of these aids has proved adequate.

Nine cases are reported.

W. W. WATKINS, M.D.

Congenital Torticollis with Malformation of the Seventh Cervical Vertebra and Painful Shoulder. Dr. Nov-Josserand, Lyon chir., 19:797-799, Dec., 1922.

A CASE of congenital torticollis is presented. An induration of the right, sternocleidomastoid muscle was noted at birth, the delivery being

effected by application of forceps. At 6 years of age, there was torticollis of a medium degree, some slight facial asymmetry, cervical scoliosis with the convexity to the left, and slight occipital compensation.

A resection of the sternomastoid muscle brought about a complete correction with no after effects for many years.

For the past two years the patient has experienced pain in the right shoulder, especially in certain movements as in putting on clothes or playing tennis.

Examination shows the painful spot localized on the anterior surface of the shoulder medial to the coracoid process. There is also slight atrophy of the arm as compared to the one of the left side, but no disturbance of sensibility. The pain does not radiate to the arm.

The roentgenogram of the shoulder gave normal findings. The one of the cervical spine revealed an abnormally long transverse process of the seventh cervical on the right side, twice the length of the transverse process of the first dorsal, with complete absence of a process on the left side.

The author is of the opinion that the muscular retraction on the right side was not caused by any obstetrical traumatism, but by an ischemia resulting from the spinal anomaly; that although the case appeared to be typical of a muscular torticollis, yet the spinal malformation is to be regarded as the actual cause.

The author treated another case of muscular torticollis associated with scoliosis. A roentgenogram revealed a fissured posterior arch of the axis forming two unequal branches.

A. M. PFEFFER, M. D.

Sacroiliac Arthrosis Obliterans. E. S. Blaine, M.D., *Am. J. Roentgenol.*, 10:189-194, March, 1923.

CAREFUL x-ray study and clinical examination of all patients suffering from backache should be made.

Out of 1,800 lower spine cases the author found 18 with unusual changes in the sacroiliac joints; all these cases were under 30 years of age and some were younger than 25 years. Complaints were of dull pain, soreness, stiffness and discomfort. There was more or less spinal rigidity, considerable limitation of motion and slight tenderness over the sacroiliac parts and the lower lumbar parts of the spine, and in some the normal lumbar curve was obliterated. The condition is very slowly progressive. The x-ray will

show gross intrinsic joint changes, the majority of these being bilateral. Intimate changes cannot be demonstrated. A combination of destructive and constructive changes is the essential alteration, seeming to indicate a low grade type of joint infection of marked chronicity. "An early disease of the joint may be deduced by a comparative decrease in the sharpness of the joint edges, these appearing to be somewhat hazy in shadow detail." A further advance in disease is indicated by erosion of the articular surface edges, and a still further degree is indicated by a material decrease in the interarticular distance between the sacrum and the ilium. These two bones may come in contact and may even fuse.

In the differentiation from typhoid arthritis the history is the only aid mentioned. In chronic hypertrophic osteoarthritis the articular surfaces will present less change and there will not be the erosion of the articular surfaces. Also many joints may be involved which is not the case in the lesion named in the title of this paper. In tuberculous arthritis of the sacroiliac joints the lesion is seldom bilateral and produces rather extensive softening of the cancellous bone tissue in the surrounding bones with far greater destruction of tissue.

The author contemplates further study and presentation of this subject.

The Association of the Surgeon and the Radiologist in Bone Grafting. St. I. D. Buxton, M.B., B.S., *Arch. Radiol. & Electroth.*, 27: 289-304, March, 1923.

THE FATE and the effect on the bone of metal plates, bolts and bone grafts introduced into the tissues in the treatment of fractures may be ascertained by the x-ray and is a wonderful aid in surgery. A loose plate, the formation of a false joint or the fracture of a bone graft is often thus diagnosed. It is said that the function of periosteum, bone, and the method of union following bone grafting can be studied by radiography as well as by the microscope.

Surgical procedure is discussed in detail and the exposition of radiographic diagnosis is aided by 24 illustrations.

Outline of Ultra-Violet Therapy. By A. I. Pacini, M.D., 12mo., 204 pp., 22 illus. Cloth, \$3.50. Chicago, Poole Bros., 1923.

THIS BOOK discusses the general principles involved in ultraviolet therapy. The author remarks that the

vastness of this subject and the unorganized state of the knowledge pertaining thereto has made it difficult to attain logical sequence in its presentation. However, he has succeeded in assembling the pertinent facts and elucidating the principles of ultraviolet therapy in an enlightening and useful publication, published in a very convenient size and printed in very readable type. Besides the 22 illustrations, mostly of apparatus, there are numerous therapeutic tables of value in practice.

Chapter I deals with the general principles involved in the subject of ultraviolet radiation. Chapter II treats of the properties of the air cooled lamp, Chapter III of those of the water cooled lamp. Chapter IV discusses regional actinotherapy, most of the space being devoted to the subject of gastric disorders. It also contains an interesting page upon subjective and objective pain. Chapter V deals with pelvic visceral disorders. In this chapter the author warns against over enthusiasm in the use of ultraviolet therapy in these lesions, but strongly advocates its sane and wise application.

Chapter VI defines and gives directions for using fractional actinotherapy. This method combined with the usual therapeutic measures has been found very useful in the various tuberculo-pathies. The following chapter takes up the subject of systemic actinotherapy. The systemic uplift resulting from general ultraviolet treatment is largely due to the increased hemoglobin content and increased calcium metabolism and is of great value in cancer treatment by whatever method. General treatment is of very great value in certain diseases of the bones, and in some of these it is almost a specific. Rickets, achondroplasia, osteogenesis imperfecta and osteomalachia are discussed in relation to ultraviolet therapy.

Chapter VIII has for its subject intensive actinotherapy, and the principles of stimulative, regenerative and destructive erythema dosage are here discussed together with the disease conditions in which they have been found to be of value.

Chapter IX, "Bactericidal Actinotherapy," is an interesting chapter. The last two chapters are upon "Abiotic Actinotherapy" and "Actinotherapy in Metabolism," and are equally interesting.

The lack of an index and a number of typographical errors are the criticisms that the reviewer would offer upon this excellent publication.